SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Prof. J. McKeen Cattell, Garrison-on-Hudson, N. Y.

SCIENCE IN COLLEGE ENTRANCE EXAMINATIONS.

THE advancement of science is so intimately related to the study of science in schools and colleges that the recent efforts to improve and unify college entrance requirements deserve consideration. At the meeting of the National Educational Association in 1895 a committee of ten was appointed, in which secondary and higher education were equally represented, and this committee has prepared tables (published in *The School Review*) giving the subjects required in sixty selected colleges and universities.

Courses leading to the degrees of A.B., Ph.B. and B.S. are considered separately. The multiplication of degrees seems to be needless. In the great universities of Germany and Great Britain the same degrees are given for classical, literary, historical, philosophical and scientific studies, and there is no good reason why the confused American system should not be simplified, as has been done at Johns Hopkins, Columbia and Stanford Universities, by giving only the degrees of A.B. and Ph.D. for suitable courses of liberal study. With our present elective system a degree may represent a given amount of culture, but it

is absurd to devise degrees for each kind of information. We may regard the Ph.B. degree as already antiquated, but we must for the present consider the courses leading to the degrees of A.B. and B.S.

It appears that of fifty-six institutions, eighteen, including, we regret to say, several leading universities, neither require nor allow entrance examinations in science. To offer courses leading to the degree of B.S., and not encourage the preliminary study of science, seems unreasonable. Under such conditions it is not surprising that the degree should be commonly regarded as of less value than the A.B. Strange as it may appear, seven leading scientific and technical schools unite in requiring history for admission, but only three allow any science, and of these the Sheffield Scientific School of Yale University only asks for botany. These schools all want modern languages, and propose to examine students on Chamisso, Schiller, Corneille and George Sand, but do not recognize the importance of reading scientific texts in French and German.

Among the colleges requiring or permitting entrance examination in science, 32 propose physics, 24 chemistry, 22 biological subjects, and 16 physiographic subjects. These figures, however, refer to the three degrees; only 21 institutions offer examinations in science for the course in arts. It must be remembered that even these scant requirements relate, in many cases, to the superficial memorizing of a text-book. Those universities that recognize a proper preparation in physical and natural science deserve to be enumerated; they are Harvard, Johns Hopkins, Chicago and Stanford Universities and the State Universities of Michigan, Wisconsin, Minnesota, Illinois, Colorado, California, Nebraska and Indiana. While we regret that our roll of honor is so short, we regard the names on it with satisfaction. Harvard has always led in educational progress; Johns Hopkins, Chicago and Stanford have planned their courses and not inherited them; the great State universities have developed in touch with the public schools and the needs of the people.

While the present state of affairs is very bad, the outlook is not at all discouraging. Every change is in the direction of increased recognition of the sciences. Since the report of the N. E. A. Committee was prepared, Columbia has joined Harvard and Johns Hopkins, leaving Pennsylvania, Princeton and Yale in the rear. Further the causes of the present discrimination against the sciences are fortunately such as can be and are being removed. One of these is the difficulty of teaching science adequately in the high school and in the private preparatory school. There has been a lack of proper teachers, proper text-books and proper laboratory equipment. But in all these respects there has recently been great improvement; and it seems likely that the school will lead the way, forcing the college to accept the preparation of which the community approves. If the boy likes to study science better than Latin grammer, and if the Latin of the school is unprofitable to the great majority of boys who never go to college, it would seem to be only a question of time when facts will take the place of argument and compel all colleges to acknowledge preparatory study in science.

A second obstacle has been the lack of agreement among educators and men of science as to what science should be taught in the school and how it should be taught. Even the quasi official report of the member representing science on the Committee of the N. E. A. states that physiography is not a fundamental disciplinary study, calls the study of natural history sham biology, and says that neither physiography nor biology can be studied without previous training in physics and chemistry. But we think that partial points of view will supplement each other as the subject is discussed in journals and in meetings such as that of the department of Natural Science Instruction of the N. E. A., and that of the recently organized New York State Science Teachers' Association. We believe that courses can be arranged extending from the kindergarten to the college that will not only supply the student with information of enduring practical value, but will also give him a training and a culture not otherwise attainable.

The most serious obstacle in the way of science in college entrance examinations is, however, tradition, and this is an obstacle that consumes itself. For centuries the classics were a necessity and there was no science. A certain amount of conservatism is always desirable; we want growth rather than revolution. It is probable, however, that there are some college presidents who do not know that at Cambridge University most of the students take the B. A. degree without studying a word of Latin or Greek at the University. We believe that the survival of the fittest is the best method of development. We do not ask that science be required in entrance examinations, neither do we wish to see classical studies excluded, but we think it reasonable that science and classics should be treated with equal fairness.

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*THE AIM OF PHYSICAL CHEMISTRY.**

A PAPER bearing the above title was read by Prof. Nernst at the opening of the new laboratory for physical chemistry and electro-chemistry at the University of Göttingen, on the second of June last. This is the third chair that Germany has devoted to the study of that region, which lies intermediate between physics and chemistry. First, in point of time must be mentioned that of Landolt in Berlin, while the laboratory of Ostwald, in Leipsic, is more directly connected with the newer developments in that field which has been systematized into a distinct science largely by Ostwald himself. Indeed, much of the best work of Arrhenius and Nernst was done while they were associated with Ostwald, so that the title 'Leipsic school,' has come to have a definite significance. It is now well known that Leipsic will soon be provided with a physico-chemical building and equipment which, in point of completeness, will have no rival.

The new structure in Göttingen has been erected to meet the growing demands of physical chemistry in that university, under the guidance of Prof. Nernst. At the formal opening there were present such men as Arrhenius, Beckmann, Borschers, van't Hoff and others. Ostwald and Landolt were prevented from attending. The following are some of the more important points which were brought out by Nernst on that occasion.

To-day we are furnished with new evidence that an intimate reunion is being effected between two branches of science

* Published by Vanderhoeck and Ruprecht. Göttingen, 1896.

which have become separated. A reunion, since a separation, which does not date from a very early period, took place. Newton, the Father of modern physics, wished to apply his law of force to cosmic phenomena as well as to chemical. Even at the beginning of this century we find men like Dalton, Wollaston, Ampère, Davy, Dulong, Gay Lussac and others, who have simultaneously enriched both physics and chemistry. The separation came later and we recognize Weber, Helmholtz, Kirchhoff, Clausius, Fr. Neumann, Kundt, Hertz, as distinctly physicists, while Berzelius, Dumas, Liebig, Wöhler, Hofmann, are as distinctly chemists. It is also true that there were a few, contemporary with the above named, whose work enriched both physics and chemistry, notably, Faraday, Hittorf, Horstmann, J. W. Gibbs and the cooperation of Kirchhoff and Bunsen, and Guldberg and Waage. But that a marked separation of physics from chemistry had taken place is beyond question.

The time at which this began to be pronounced was about the year 1835. A decided tendency to reunite was observed in the year 1885. It was at this latter date that van't Hoff's epoch-making work on solutions appeared, and in the same year Ostwald published the first volume of his *Lehrbuch*. Since that time the number of those who are at once physicists and chemists has greatly increased.

If we ask what is the difference between physics and chemistry it is generally replied that chemistry has to do with the composition and structure of the molecules, while physics deals with the molecules already made, but this distinction is founded on a special hypothesis, the atomic hypothesis, which cannot be regarded as a general principle on which to base such a division. If we state that physics investigates those natural phenomena in which the properties of matter remain unchanged, while chemistry studies the transformations of matter, the distinction does not always agree with the facts.

On the other hand, physics and chemistry have much in common which is distinctive. The other branches of natural science find the objects of their investigations existing in the external world. The zoologist, the physiologist, the astronomer, have their material already prepared for them. Their work is *descriptive*. The chemist and physicist prepare their own materials, and their science is *constructive*. But what is the real difference between physics and chemistry, which are taught in separate laboratories and by specialists in each branch? The distinction is one which is deeply imbedded in the mind of the investigator. He who would become a physicist must acquire a good mathematical training, while a chemist must be acquainted somewhat with mineralogy, physiology and botany. Further, it is difficult to preserve physical apparatus in the presence of the destructive fumes of the chemical laboratory, and consequently such apparatus is usually absent from, or in poor condition in, the chemical laboratory. For the same reason the physicist avoids the 'chemical kitchen' in his apartments. Thus the distinction which existed between physics and chemistry for a half-century (1835–1885) was a necessity and contributed largely to the advance of our knowledge of the natural sciences. And those same causes which have made the separation of physics from chemistry a necessity are still operative to some extent, so that no one thinks at the present day of combining the physical and chemical laboratories into one. But like two great nations which have been brought more closely together by common interests, physics and chemistry will have more and more points in common the further investigation is carried. Physical chemistry is the diplomatic agent to

effect this. "If the physicists and the chemists work each in their own field and with their own methods, a large area between the two will remain untilled, viz., all that which can be cultivated only by the simultaneous application of both methods of work. That physical chemistry finds here an enormously large and fruitful field for activity is distinctly shown by the scientific advances of the last decade."

One may fairly ask why has this point of view presented itself for the first time, in the last few years? This is the answer: "*In the fifty years previously referred to, there were discovered a number of general natural laws, which were particularly important and useful because of their simplicity. These made it possible for the investigator to comprehend a very large number of facts in a few words or formulæ.*" It has thus become relatively easier for the physicist and chemist to know something of that science which belongs more directly to the other. In reality, such knowledge has become necessary on the part of both. The physicist cannot understand electrical phenomena and thermodynamics without a knowledge of the law of chemical mass action and an intelligent comprehension of purely chemical phenomena. The chemist, in turn, must have a fair knowledge of electricity in order to comprehend electro-chemical processes. Indeed the inter-relation of physics and chemistry has become so pronounced that a specialist in each can work over only a limited range without having to take the other into account. The remainder of this interesting address is devoted more particularly to a discussion of the nature of the work which it is proposed to carry on in the new laboratory in Göttingen.

In connection with what has already been accomplished by physical chemists since their branch has become a distinct science (which is hardly more than a decade), it seems desirable to call attention to some of the generalizations which have been reached by them; and what is so important in physics, and especially in chemistry, as a generalization, which brings together and interprets at least a few out of that chaos of facts whose real significance and meaning are for the most part unknown.

The generalization of van't Hoff that 'optical activity' is due to the presence of an asymmetric carbon atom, was the foundation for all the recent developments in stereochemistry in the hands of Wislicenus, Hantzsch, Werner, V. Meyer, Auwers and others. His application of the gas laws to solutions, and its counterpart, the Arrhenius theory of electrolytic dissociation, have a significance the breadth and depth of which are just beginning to become apparent. Further, his studies in chemical dynamics, though less known, are probably his greatest achievements. The work of Ostwald is of too general a character to specify details. We owe to him preeminently the systematic classification, into a science, of those facts which it required a century to ascertain. Scarcely less interesting are the theoretical deductions of Nernst, who has pointed out the real source of the electromotive force in Voltaic and other elements, so clearly and correctly that our ideas in regard to primary batteries have been largely revolutionized since the appearance of his well known paper in 1889. From the theoretical side we must not forget the application of thermodynamics to physics and chemistry by Horstmann and J. W. Gibbs, and the wide significance of the law of Mass Action, even should they date from a slightly earlier time. And hardly less important than the theoretical advances which we owe already to physical chemistry are the experimental. One need mention only the work of Raoult and Beckmann on freezing points and vapor tensions, of Le Blanc on polarization, of Ramsay and Shields on

surface tension, or of Ostwald on conductivity, to verify this statement.

If in so short a time such advances have been made, it seems reasonable to expect much from work in this very imperfectly explored field, which belongs neither to physics nor chemistry, but is a distinct region, lying between these two, and employs, in addition to its own, some of the theoretical and experimental methods belonging to both.

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TAPIRS PAST AND PRESENT.

An important contribution to our knowledge of the structure and origin of the tapirs has recently been made by Mr. J. B. Hatcher,* of Princeton University. The distribution of the recent tapirs remained an enigma until the discoveries by paleontologists solved the problem. We now know that in former geological epochs, and as early as the Oligocene, the true tapirs were generally distributed over the northern hemisphere of both continents, and that probably owing to geographical and climatic changes the present tapirs were stranded as it were in two widely separated areas of the the globe, that is to say, in the Malay Archipelago and in South America.

In a number of the mammalian orders, there are types of great interest to the morphologist, which are called generalized or collective types. These forms include many characters in their structure which are primitive, and they are of great assistance in unravelling the phylogenetic history of the mammalia. The tapir is such a generalized member of the perissodactyle division of the ungulates, and it represents in a certain degree, especially in the structure of the feet, the ancestral type from which arose all the modern odd-toed ungulates.

* Recent and Fossil Tapirs, by J. B. Hatcher, Am. Jour. Sci., March, 1896.

It is surprising how little change the tapir has undergone since the Oligocene, and the genus *Protapirus* based upon the dental characters alone can hardly be separated generically from the recent tapir. The structure of the skull in *Protapirus* is decidedly more primitive than that of any of the living tapirs. In *Protapirus validus*, of the White River Oligocene of the United States, the skull is elongated and compressed, in contrast with recent species the nasals project farther forward, and consequently the proboscis in this ancient tapir was probably much smaller than in recent forms. The shape of the nasal bones is quite different from that of recent tapirs, as in these the nasals are deeply excavated proximally into fossæ which lodge the large air sinuses. In *Protapirus*, however, these fossæ are represented by two long and narrow grooves, one on each side of the nasals, and these grooves extend farther forward on the skull than in the living tapirs.

In *Protapirus validus* the cranial portion of the skull is much elongated and the sagittal crest is prominent; on the other hand, the postglenoid and paroccipital processes are united and close the external auditory meatus inferiorly. This is decidedly a specialized character of *Protapirus* and is not found in the skull of any of the existing tapirs. In comparing the recent with the fossil tapirs Mr. Hatcher finds that the skull of *Tapirus roulini* (Syn. *T. pinchacus*) more closely resembles that of the fossil *Protapirus validus* than any other of the living tapirs. *Tapirus roulini* is rather aberrant in its distribution, as it is found in the high latitudes of the Andes. The osteology of this species has been very fully described by Döderlein.*

I see no use in reviving the generic name *Elasmognathus* Gill. The ossification of the mesethmoid in this form is not considered

* Über das skelet des Tapirus Pinchacus, Inaugural Dissertation, Bonn, 1877.

a valid generic character by most authorities. The absence of a sagittal crest in *Tapirus bairdii* and the molariform structure of the second superior premolar, a character which is found in other species of *Tapirus*, can hardly be considered of generic value.

The relations of the American and European species of fossil tapir have been very fully discussed by Wortman* and Earle, and since their paper was written I have studied the original types of *Protapirus* occurring in the Eocene and Oligocene of France. I see no reason in changing the conclusions stated by these authors. The opinion† has been advanced that the fossil tapir from the Lower Miocene of St. Gérand-le-Puy, in France, was really a species of the American genus *Colodon*. I strongly dissent from this idea, as, after having examined the original type of *Protapirus douvillei*, I can confidently state that it is a true tapir and not very closely related to *Colodon*. Again, *Protapirus priscus* of the Phosphorites belongs in the same genus as the remains of the animal from St. Gérand-le-Puy. As the Phosphorites is 'un grand mélange,' the position stratigraphically of the French species of *Protapirus* is about the same; the Phosphorites probably including the space of time, between the Upper Eocene, Gypse de Paris, and the Lower Miocene or Oligocene, of St. Gérand-le-Puy. As the evidence now stands I can see no reason for burdening paleontological literature with another new name for the American forms of *Protapirus*.

In my opinion there is ample proof to show that the American genus *Hyrachyus* occurs in the Middle Eocene of France, Argenton. Monsieur Filhol‡ has described a lower jaw with complete dentition and also isolated upper molars, which agree structurally with those of the typical *Hyrachyus* of the Bridger.

In conclusion I do not see that Mr. Hatcher brings forward any new evidence to prove that the line of the true tapirs was not already in the Middle Eocene, Bridger, perfectly distinct from that of the pseudo-tapirs.

Osborn and Wortman have described the structure of the feet in *Heptodon calciculus* of the Wind River Eocene, and these authors have shown that in *Heptodon* the middle metapodial was already enlarged, as compared with the lateral metapodials, and this increase in size, tending to monodactylism, culminated in the genus *Colodon* of the White River Oligocene.

The ancestral form of the true tapir from the Bridger is not yet clearly made out, as the relationship of the two species of *Isectolophus* to the tapir phylum is rather obscure.

CHARLES EARLE.

NEW ROCHELLE, N. Y.

* Bull. Am. Mus. Nat. Hist., Aug., 1893.

† Bull. Am. Mus. Nat. Hist., Dec., 1895, p. 362.

‡ Mém. sur Lophiodon, Mém. Soc. Géol. de France, 1888, Tome V.

ON THE OCCURRENCE OF TROCHOSPHÆRA SOLSTITIALIS IN THE ILLINOIS RIVER.

THIS interesting and remarkable rotifer occurred sparingly in collections made at the biological station of the University of Illinois during the months of June, July and August, in the summer of 1896, in the Illinois River at Havana, and in a permanent marsh in the adjacent bottom-lands locally known as Flag Lake. The species was described by Surgeon Thorpe, R. N., from collections made in August, 1892, in a pond near Wuhu, on the Yangstze-Kiang River. As its specific name indicates, it differs from *T. æquatorialis* Semper, in the position of the girdle of cilia. Semper's species, found in 1859 in the rice fields of the Phillipine Islands, was also rediscovered by Thorpe in 1889 in ponds of the Acclimatization Society at Brisbane, Australia. Of its occurrence elsewhere nothing

is known. The distribution of this genus, as hitherto reported, is thus clearly antipodal, and its occurrence in our inland waters is, therefore, of more than passing interest.

It is well known that many of our rotifers are cosmopolitan. Thus, at least two-thirds of the thirty-one species reported from Wuhu as associated with *Trochosphæra* are also found at Havana. Again, *Notholca longispina*, originally described by Prof. D. S. Kellicott, from the Niagara River, has since been found to have a wide distribution in Europe; *Rotifer mento* and Anderson, discovered at Calcutta in 1889, was found by Dr. Jennings in 1893 in great abundance in Lake St. Clair. It may then be that *Trochosphæra* also is a cosmopolitan form.

One circumstance, however, seems to militate against this view. *Trochosphæra* was not reported from any one of our 505 collections made from April 1, 1894, to May 13, 1896, in the Illinois River or its adjacent waters. A re-examination of the river collections prior to June, 1896, made especially for *Trochophæra*, has been fruitless. Importation is thus suggested to account for its sudden appearance this year in the river at Havana. Rice straw and bamboo from the Orient were not uncommon at the World's Fair in Chicago in 1893, and it may be that they smuggled in our visitor from China. Mr. Thorpe, in a discussion this year before the Royal Microscopical Society of London, maintained that rotifers, in their distribution, seemed to follow the footsteps of man, and that those found in foreign countries which had been colonized were frequently of the same kind as those of the countries whence the immigrants originally came. He had found, in Australia, for example, "the most abundant material always in ornamental waters in botanical gardens and in the immediate precincts of civilization, and the forms were such as left no doubt that in some way or other they had been introduced by the agency of man, for, as Dr. Hudson had remarked, a foot of salt water was as great a barrier to rotifers as an ocean."

Other agencies than the movements of man are beyond question active in the distribution of these minute members of the aquatic fauna. Their winter eggs are blown about in dust, it may be for considerable distances; or they may take passage on the feet or plumage of water-birds from distant lands. It is therefore but the merest conjecture to attribute the occurrence of *Trochosphæra* at Havana to introduction by man, especially in view of the paucity of information in regard to the minute fauna of our inland waters.

This preliminary note is published in the hope that it may lead to a wider knowledge of the distribution of this interesting member of the river plankton.

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CURRENT NOTES ON ANTHROPOLOGY.

THE ENGLISH 'ROUND BARROW' STOCK.

Few questions in English archæology are more difficult, and at the same time more important in the light their solution would throw on proto-history, than that relating to the people who built the 'round barrows' or graves. Their skulls are very much alike, highly brachycephalic, the parietal eminences projecting, the glabella and chin prominent.

Mr. C. S. Myers discusses them in an article on some old skulls from Suffolk, in the Journal of the Anthropological Institute, November, 1896. He says they were certainly not the Belgian Celts, as some have maintained. Possibly they were the neolithic Danes. But this only removes the difficulty, because we do not know to what stock these belonged. They might have been a branch of the round-headed 'Celts'

of central France, but the cranial type in other respects is not the same.

DISTRIBUTION OF ARCHÆOLOGICAL ARTEFACTS IN AMERICA.

A VALUABLE article by Mr. A. E. Douglass appears in the *Bulletin* of the American Museum of Natural History for October 26th. It explains the arrangement adopted by him for his extensive collection of American aboriginal relics. The aim is "to enable the students to determine with the least labor to what class any object in his possession properly belongs, and, by comparative study, to decide how it was used."

The geographical distribution of the various forms is discussed at length, and presented at the close of the paper in an elaborate table.

Mr. Douglass calls especial attention to the need of a uniform nomenclature for American archæology, and adds, "a point has been reached when this matter could and should be definitely settled," and offers the valuable suggestion that the Anthropological Section of the American Association for the Advancement of Science should appoint a committee for the purpose.

D. G. BRINTON.
UNIVERSITY OF PENNSYLVANIA.

CURRENT NOTES ON METEOROLOGY.

THE MONTHLY WEATHER REVIEW.

THERE was a time when the *Monthly Weather Review* of our Weather Bureau was anything but an interesting publication, for it contained little besides meteorological summaries and statistics. During the past two years, however, under the editorship of Prof. Cleveland Abbe, to whom meteorology in this country owes so much, the *Review* has taken on more of a popular character, and it now presents every month not only the usual tables and summaries, but a considerable number of longer or shorter papers and notes on different meteorological subjects. These papers come mostly from the professors and observers of the Bureau, although outsiders also contribute. Prof. Abbe himself prepares each month a set of 'Notes by the Editor.' The *Monthly Weather Review*, with the strong backing of the Weather Bureau, is doing successfully a good share of the work which the *American Meteorological Journal* carried on in this country for twelve years and which, as it did not receive sufficient financial support, it was obliged to discontinue last April. The September number of the *Review* presents an unusually large number of interesting articles, and an idea of their scope may be obtained by noting some of their titles and authors, which follow: S. P. Fergusson: 'Kite Experiments at the Blue Hill Meteorological Observatory' and 'A High Kite Ascension at Blue Hill' (an account of the kite work at Blue Hill, already referred to in these notes, which has given a large number of valuable records from the free air at heights up to over 9,000 feet); A. J. Henry: 'Progressive Movement of Thunderstorms;' Julius Baier: 'Low Presure in the St. Louis Tornado' (the readings of an aneroid give 26.94 in., with an uncertainty of .20 in., as the minimum at the center); Robert H. Scott: 'The International Meteorological Conference at Paris;' Prof. C. Abbe: 'Espy and the Franklin Kite Club,' 'Isobars and their Accuracy," 'The First Attempt to Measure Wind Force' (Sir Isaac Newton, in 1658, determined the force of a gale by jumping in the direction in which the wind was blowing and then in the opposite direction, and measuring the length of the leap in both directions).

CLOUD OBSERVATIONS IN TROPICAL PLANTS.

A RECENT paper by H. B. Boyer, Observer of the Weather Bureau at Key West, Fla., deals with *Atmospheric Circulation in Tropical Cyclones as shown by Movements of Clouds.* The author's main conclusions are as fol-

lows: In tropical cyclones, perfectly formed, the currents of the lower cloud level move in a circle, while from the alto-cumulus to the cirrus level the currents diverge from the center, the divergence increasing up to the cirrus clouds, which move directly from the center. If, when within the direct influence of tropical cyclones, it is found that the lower currents do not conform strictly to cyclonic formation, the high-current angles should be used to locate the bearing of the center, for the upper currents are not influenced by local conditions. When the upper clouds show any marked departure from the regular cyclonic current angles, there is little need of apprehending danger from storm winds, for there is then imperfect formation of the cyclone.

KITE METEOROLOGY AND WEATHER FORECASTS.

That meteorological observations made in the free air by the use of kites seem destined soon to play an important part in the making of weather forecasts has already been suggested in these notes, and is further indicated in a short paper by Hammon in the *Monthly Weather Review* for August. On August 28th two kites were flown in San Francisco during the prevalence of a moderate west wind (14 miles an hour). After an elevation of 1,000 feet was reached, the kites drifted more and more to the northward. On the next day another ascent was made and the southerly current was met at a height of 1,200 feet. On this day a very marked electrification of the air was noted. During the following night and the succeeding day a general rain fell throughout northern California, the heaviest August rain of which there is record in many places. That the unusual southerly current and the electrification of the air were associated with the rain seems evident.

REPORT OF THE CHICAGO METEOROLOGICAL CONGRESS.

Part III. of the 'Report of the International Meteorological Congress held at Chicago, August 21–24, 1893, under the auspices of the Congress Auxiliary of the World's Columbian Expedition,' has just been issued. Parts I. and II. were published some time ago. It is always a matter of regret that such a publication should be so long delayed, as it loses much of its interest on that account. The Chicago Meteorological Congress, although attended by few persons from this country and by still fewer from abroad, was the means of bringing together a large number of valuable papers, written by the leading meteorologists of the world, on all manner of topics connected with meteorology and related sciences. Our Weather Bureau has had in charge the translation and publication of these articles, and they have appeared as Bulletin No. 11, Parts I., II. and III. The present part contains the papers on climatology and on instruments and methods of investigation, prepared for Sections VII. and VIII. of the Congress.

METEOROLOGICAL WORK IN SOUTHWESTERN RUSSIA.

The admirable work done during the ten years (1886–1895) in southwestern Russia, under the direction of Dr. Klossovsky, is set forth in a publication entitled *Travaux du Réseau météorologique du sud-ouest de la Russie. Dix Ans d'Existence, 1886–1895.* The activities of this meteorological service have been varied and the results obtained have been of great value. Apart from the regular observations, extended studies have been made of the climate, agricultural and soil conditions, thunderstorms and hail-storms, distribution of rainfall, etc. Dr. Klossovsky's recent map showing the distribution of thunderstorms over the earth's

surface is the first of the kind ever published.

NOTES.

WORD has been received of the death, on October 25th, of Dr. Alberto Sanchez, director of the Meteorological and Astronomical Observatory of San Salvador.

A PAPER on Climate was read by Dines before Section III. of the Sanitary Institute, at its meeting at Newcastle-on-Tyne last summer, and has been separately published as a reprint from Vol. XVII., Part III., of the Journal of the Sanitary Institute.

R. DEC. WARD.

HARVARD UNIVERSITY.

NOTES ON INORGANIC CHEMISTRY.

IN the last number of the *Chemical News*, Prof. Crookes describes an examination of the alleged new element 'Lucium' which was patented by Barrière. The lucium was furnished by M. Barrière, and after both spectroscopic and chemical investigation was found to be impure yttrium. Didymium, erbium and ytterbium were also found to be present, which may account for the atomic weight given for lucium, 104, that of yttrium being 89. Prof. Crookes also worked up a specimen of monazite according to Barrière's patent and found that the 'lucium' obtained was the same impure yttrium.

In the same number of the *Chemical News*, Prof. Fresenius makes a disclaimer of any confirmation of Barrière's discovery of lucium.

THE constitution of the so-called nitrogen-iodid is the title of a paper in the Proceedings of the Chemical Society (London) by F. D. Chattaway. This explosive substance, the exhibition of which is familiar to every student of elementary chemistry, has had several different formulæ assigned to it, but its composition has never been satisfactorily settled, in spite of the numerous chemists who have studied it. The author concludes that it is not a mixture, and that its formula is either NHI_2 or NH_3I_2, most probably the latter, which would make it an additive and not a substitution product. This suggestion appears never to have been put forward before, and accounts well for many of the reactions of the substance.

S. HAGA in the same Proceedings considers how mercurous and mercuric salts change into each other. In general mercuric salts are changed into the mercurous when in contact with mercury and water. Mercurous salts in solution or moist when exposed to strong daylight are dissociated even at ordinary temperature into mercury and mercuric salts. In boiling water the change takes place more readily, the mercury distilling with the steam. Only at a higher temperature than boiling water are mercurous salts oxidized to mercuric, at lower temperatures the change being a dissociation. This would seem to offer an explanation of the darkening which sometimes takes place in calomel. Exposed to sunlight when slightly moist it would dissociate into mercury (occasioning the darkening) and corrosive sublimate. Old calomel is sometimes considered to be dangerously active. The physiological action of calomel would also seem to be due, not to an oxidation to the bichlorid, but to a slow solubility of the calomel in the fluids of the stomach and intestine. J. L. H.

PSYCHOLOGICAL NOTES.

THE January number of the *American Journal of Psychology* will contain a characteristic and very interesting article by President G. Stanley Hall entitled 'A Study of Fear.' President Hall sent out from Clark University thirty-two questionnaires relating to the child's mind and its development, and has secured in answer to these an enormous mass of material. He has worked over the data of one of the syllabi only, that concerned with fear, and though

the exposition is condensed it will occupy one hundred large pages. Psychology may have been lacking in concrete facts until recently, but now it seems in danger from a plethora of facts. The nearly 2,000 people who have sent in returns have described 6,456 fears. It seems that thunderstorms are feared most frequently and next reptiles; then follow strangers, darkness, fire and death. Boys report on the average 2.21 fears, while girls report 3.55. There is an increase in the number of fears up to the age of fifteen for boys and up to the age of eighteen for girls, but this is probably due to fuller descriptions from those who are older. President Hall classifies the kinds of fears, and under each heading gives a number of examples followed by a discussion. Some of the fears, such as those connected with high places, with loss of orientation and with being shut in, are psychologically of much interest. President Hall adopts an extreme genetic standpoint. He holds that "the conscious ego is but a very inadequate and partial manifestation of the soul, that it is a feeble, flickering taper in a vast factory full of machinery and operatives, each doing its work in unobserved silence." Instinct is much older than intelligence; it is inherited not only from our anthropoid ancestors, but from remotest times, associated with the persistency of cells or protoplasm rather than with a developed nervous system. The fear of high places, President Hall thinks, is a vestigal trace, like the gill slits under the skin of our necks, antedating limbs and inherited from our swimming and floating ancestors. It would be difficult to disprove President Hall's theory, but it does not seem to follow from his facts. Many prevalent fears, as of weather and serpents, are not in accord with our urban civilization, but I doubt if they will persist a century hence, let alone through millions of years. The three children of which the present writer knows most have not shown the slightest fear of thunderstorms, and had to be taught to fear snakes owing to the presence of poisonous species. Fears of death, of disease and of the end of the world are among the common ones, and these are not inherent in protoplasm. Children undoubtedly show instinctive fears, but I believe that most of their fears are learned and not inherited.

The forthcoming number of *The Psychological Review* will contain an experimental study of the physiology and psychology of the telegraphic language, by Prof. W. L. Bryan and Mr. Noble Harter, of Indiana University. Mr. Harter is himself an expert telegrapher, and has examined the methods and results of several hundred operatives, making special experiments on a large number. The highest sending record so far as known is forty-nine words per minute, by the Morse code, which would be about eight taps in each second. With those unskilled the ability to send is greater than the ability to receive, but with experts the reverse is generally the case. Twenty to twenty-four words of four letters each may be taken as an ordinary rate. Elaborate curves are given in the paper showing improvement with practice week by week. The sending curve rises more rapidly and more uniformly than does the receiving curve from the beginning of practice to the learner's maximum ability. The receiving curve rises more slowly and irregularly and shows a failure to rise for several months in two places. The curves may represent the rate of other acquisitions and show interesting differences between motor and apperceptive processes. Each operator has an individual language and none conforms exactly to the type. In order to appreciate the extensive results and many inferences drawn from them the reader must refer to the paper which is a contribution of value to the

motor problems now prominent in psychology.

WHILE experimental psychology has been successful in extending its work from sensation to movement, it has found great difficulty in devising suitable experiments on the feelings. We may, therefore, welcome a paper by Prof. Joseph Jastrow, which will appear in the January number of the *Popular Science Monthly*, entitled 'The Popular Æsthetics of Color.' At the Columbian Exposition Prof. Jastrow arranged a psychological laboratory and many visitors were tested. The results have not yet been published, but the preferences of 4,500 people for color were separately determined, and these have now been collated with interesting results. J. McK. C.

SCIENTIFIC NOTES AND NEWS.

PROF. G. SCHIAPARELLI, the Italian astronomer; Prof. A. Heim, the Swiss geologist; Prof. G. Lippmann, the French physicist, and Prof. G. Mittag-Leffler, the Swedish mathematician, have been elected foreign members of the Royal Society.

THE subject of the lecture by Mr. Alexander Agassiz before the American Society of Naturalists will be 'Methods and Problems of Deep Sea Investigation.'

DR. FRITZ WESTHOFF, docent in zoology in the Academy at Münster, died on November 12th at the age of forty years. He had published several works on the natural history of Westphalia. Dr. Strauss, professor of pathology at the Paris Medical School, known for his writings on tuberculosis and cholera, has died at the age of fifty-one. Dr. Ernst Engel, formerly director of the Prussian Statistical Bureau, has died at Lössnitz at the age of seventy-six. The death is also reported of M. Alfred Nobel, the inventor of dynamite.

LORD RAYLEIGH and Prof. W. Ramsay have been elected corresponding members of the Berlin Academy of Sciences.

THE celebration of Lord Kelvin's jubilee as professor of natural philosophy in the University has been followed, says the *Lancet*, by the recognition of his jubilee as a member of the Glasgow Philosophical Society. The society have presented Lord Kelvin with an address and elected him an honorary member. A bust, subscribed for by the members, has been placed in the Society's rooms and a replica presented to Lady Kelvin. The proceedings in connection with these events were presided over by Dr. Ebenezer Duncan, the president of the Society, and the address was read by Dr. Freeland Fergus, the honorary secretary.

A MONUMENT in honor of the engineer Grashof was unveiled at Karlsruhe on October 26th. An address was made by Prof. J. Hart, giving an account of Grashof's contributions to Science.

THE annual *Fest Sitzung*, of the Munich Academy of Science was held on November 14th. Prof. Walther Dyck made an address on the relations between pure and applied mathematics.

THE German Geographical Congress will hold its eleventh meeting at Jena on April 21st, 22d and 23d. Among the subjects proposed for discussion are polar investigations, physical questions (earthquakes, etc.), biological geography, the topography and natural history of Thuringia, and the teaching of geography in schools.

THE celebration at Lisbon of the fourth centenary of the discovery of the maritime route to India, by Vasco da Gama, has been postponed from July, 1897, the anniversary of his sailing from Lisbon, until May, 1898, the anniversary of his arrival at Calicut.

UNDER the auspices of the Academy of Science, Letters and Arts of Rovereto, a committee has been appointed which is making arrangements to celebrate at Rovereto, in the spring of 1897, the centenary of the birth of the eminent philosopher, Antonio Rosmini.

THE *Lancet* states that there will be held in Berlin in October, 1897, a conference of delegates of different Governments to discuss the steady increase of leprosy and the apparent failure of all measures to check this plague. The date of the conference had been fixed for the month of March, but Prof. Koch's absence necessitated a

postponement, it being decided to await his return. The organizing committee comprises the following names: A. Hansen, Bergen, Norway; Robert Koch and O. Lassar, Berlin, and Edward Ehlers, Copenhagen (secretary).

At the 111th meeting of the American Institute of Electrical Engineers, held at New York on December 16th, a discussion on the Röntgen rays was opened by Prof. Rowland.

The American Historical Association holds its twelfth annual meeting at Columbia University, New York, December 29th–31st.

It is proposed, says *Nature*, to hold an international electrical exhibition at Turin in 1898. The Executive Committee and the Special Commission invite exhibits from all parts of the world, and the exhibition will comprise the following classes: (1) Apparatus for teaching electro-technics; (2) materials for the conduction of electricity; (3) instruments for electric and magnetic measurements; (4) telegraphs and telephones; (5) signalling apparatus and safety appliances on railways, lighting and heating of carriages; (6) dynamos and motors; (7) mechanical appliances and electric traction; (8) electric lighting; (9) electro-chemistry and electro-metallurgy; (10) miscellaneous; (11) apparatus of historic interest. Signor Galileo Ferraris has been appointed President of the Commission.

The College of Physicians of Philadelphia announces that the next award of the Alvarenga Prize, being the income for one year of the bequest of the late Señor Alvarenga, and amounting to about one hundred and eighty dollars, will be made on July 14, 1897, provided that an essay deemed by the Committee of Award to be worthy of the prize shall have been offered. Essays intended for competition may be upon any subject in medicine, but cannot have been published, and must be received by the secretary of the College on or before May 1, 1897.

The Walsingham gold medal, Cambridge University, has been awarded to W. McDougall, B. A., of St. John's College and St. Thomas's Hospital, for original researches in physiology.

We learn from *Natural Science* that a memorial statute to Dr. H. Burmeister is being erected by subscription in Buenos Ayres to commemorate his long and important services to science, and especially to the National Museum. The Argentine government is said to have refused permission for it to be set up in a public place, because Dr. Burmeister was a foreigner, and it will occupy a position in the hall of the University.

It is reported that Mrs. H. M. Converse, of New York City, will present to the State Regents Department, Albany, her fine collection of Indian relics. The State Legislature last winter appropriated $5,000 to classify and arrange the relics now in the State Museum.

Col. Coleridge Grove has given the Royal Institution, London, a bust of his father, the late Sir William Grove.

Nature quotes from the *Daily Chronicle* news of a meteorological observatory to be placed by Italian men of science on the summit of Monte Rosa. Queen Margherita, herself an expert mountaineer, supports the project by a donation of 160*l.*, the Duke of the Abruzzi gives 200*l.*, and the Italian Alpine Club, the Ministers in their private capacity, and the physical faculty of the University of Turin, figure among its chief contributors. It is intended to utilize the hut on the Gniffetti peak, built three years ago as a shelter for climbers. Situated at a height of about 14,000 feet above sea-level, the observatory will, as regards elevation, rank fourth among the twenty-seven mountain observatories of the world, being surpassed in altitude only by those of Arequipa, Mont Blanc and Pike's Peak.

Cablegrams to the daily papers report earthquake shocks throughout Great Britain occurring at 5:30 a. m. on December 17th. The shocks lasted from 4 to 30 seconds and are said to have been the most violent experienced in England.

The Association of American Steel Manufactures, at a meeting held in New York on October 23d, adopted resolutions endorsing the decimal system as the proper standard for measuring all materials. The British Chamber of Commerce of Alexandria are unanimously of the opinion that it would be an advantage for commerce with Great Britain, should the metric system be adopted by that country.

THE *Medical Record* states that Dr. Luys, of the Salpêtrière Hospital, Paris, has presented the Faculty of Medicine with his collection of twenty-two hundred brains, carefully prepared and catalogued. The collection is the result of thirty years' investigations, and includes the brains of idiots, of blind persons, of persons who had undergone amputation, and of those who had suffered from various forms of mental disorders.

BY a vote of 196 to 41 the congregation of Cambridge University passed a grace, on December 10th, setting aside a portion of the Downing College site, recently acquired by the university, for the Sedgwick Memorial Museum.

PROF. ANGELO HEILPRIN will contribute to the January number of *Appleton's Popular Science Monthly* a summary of our present knowledge of the Antarctic region, with a sketch map giving the more important points that have been named by navigators.

A PRELIMINARY meeting, with the object of founding a memorial to Edward Jenner, was held at St. George's Hospital, London, on December 7th, under the presidency of Sir Joseph Lister. According to the report in the London *Times* the chairman said that it was hardly creditable to England that, while other nations were in different ways celebrating the centenary of Jenner's great discovery, we in his own country should not be doing so in any adequate manner. It had been suggested that the statue of Jenner in Kensington gardens might be moved to the open space in front of the hospital, to correspond with the Wellington statue. The cost would be very slight in comparison with the funds which they might fairly hope to collect. The Bishop of Rochester, in moving "That the present year, being the centenary of the first successful vaccination, is a proper time to inaugurate a work of national utility in honor of Edward Jenner," said that it was a matter of general human and national concern, and if there was any profession which was bound to seize opportunities of going along with the medical profession in a matter of that kind it was the profession to which he belonged. The resolution was carried after speeches from Lord Reay, Sir R. Quain and Prof. M. Foster. Lord Glenesk moved "That a subscription be set on foot with the view of founding some institution, of a nature to be hereafter determined, in connection with the British Institute of Preventive Medicine, to be distinguished by Jenner's name." The resolution was supported by a number of speakers and the nature of the memorial was discussed. It was finally decided that a public meeting be called early in 1897 to decide on the form of memorial.

WE quoted recently from an article by Prof. D. T. MacDougal, recommending the establishment of an American tropical laboratory for botanical research. The last number of the *Botanical Gazette* also urges in an editorial article the establishment of such a laboratory. It is suggested that this might be accomplished most easily by the cooperation of several universities. "Perhaps the original cost should be borne by private subscription, and the running expenses met by the different universities pledging themselves for so many tables. At least the subject deserves to be taken in hand by a committee of botanists and investigated in all of its bearings. A study of the map will show that the conditions to be met favor either the east coast of Mexico or the islands near the Caribbean Sea. It is estimated that a trial station might be maintained on one of these islands for one year at a cost of $5,000; and after the selection of a permanent station the laboratory buildings might be constructed and extended according to the demand. The use of grounds necessary could be obtained from the government, and the area should embrace all levels so far as possible, a feature at Buitenzorg which is nearly ideal. It is to be hoped that a reconnoissance party of American botanists will soon visit the region proposed and report as to possible sites. Such a visit should be made before the botanical meetings of next summer, to which the report would be most appropriately made."

AMONG the lectures to be given during the winter at the Royal Institution are the following: Prof. Augustus D. Waller, twelve lectures on 'Animal Electricity;' Prof. Henry A. Miers, three lectures on 'Some Secrets of Crystals;' Dr. J. W. Gregory, three lectures on 'The

Problems of Arctic Geology;' Prof. W. Boyd Dawkins, three lectures on 'The Relation of Geology to History;' Mr. Walter Frewen Lord, three lectures on 'The Growth of the Mediterranean Route to the East,' and Lord Rayleigh, six lectures on 'Electricity and Electrical Vibrations.' The Friday evening meetings will begin on January 22d, when a lecture will be given by Prof. Dewar.

According to a note in *Natural Science* the report of the trustees of the Australian Museum, Sydney, is chiefly remarkable for the record of 2,231 mollusca added to the collections in 1895. Among the donors, the chief was Mr. W. A. Horn. A large collection of fossil Bryozoa was presented by Mr. R. Etheridge, jr. The usual want of funds has prevented the trustees from acquiring many specimens of great value, and this same want has seriously stopped collecting work, from which alone one can acquire duplicates to exchange with other institutions. One of the most important acquisitions during the year was one of Captain Cook's original MS. journals, the Log of the 'Endeavor,' presented by Mr. F. H. Danger. A curious and unfortunate event was the destruction of the entire roof over the central part of the main building by white ants. This had to be shored up immediately on discovery, and the erection of a new roof will at once be proceeded with.

In a recent issue *Nature* gives a detailed account of the report of the royal commission on vaccination. As to the effect of vaccination in reducing the prevalence of, and mortality from, small-pox, they conclude: (1) that it diminishes the liability to be attacked by the disease; (2) that it modifies the character of the disease, and renders it (*a*) less fatal, and (*b*) of a milder or less severe type; (3) that the protection it affords against attacks of the disease is greatest during the years immediately succeeding the operation of vaccination. It is impossible to fix with precision the length of this period of highest protection. Though not in all cases the same, if a period is to be fixed, it might, we think, fairly be said to cover in general a period of nine or ten years; (4) that after the lapse of the period of highest protective potency the efficacy of vaccination to protect against attack rapidly diminishes, but that it is still considerable in the next quinquennium, and probably never altogether ceases; (5) that its power to modify the character of the disease is also greatest in the period in which its power to protect from attack is greatest, but that its power thus to modify the disease does not diminish as rapidly as its protective influence against attacks, and its efficacy during the later periods of life to modify the disease is still very considerable; (6) that re-vaccination restores the protection which lapse of time has diminished, but the evidence shows that this protection again diminishes, and that, to ensure the highest degree of protection which vaccination can give, the operation should be at intervals repeated; (7) that the beneficial effects of vaccination are most experienced by those in whose case it has been most thorough. We think it may fairly be concluded that where the vaccine matter is inserted in three or four places it is more effectual than when introduced into one or two places only, and that if the vaccination marks are of an area of half a square inch they indicate a better state of protection than if their area be at all considerably below this."

UNIVERSITY AND EDUCATIONAL NEWS.

Dr. E. N. Potter has resigned from the presidency of Hobart College.

Dr. W. E. Castle has been appointed instructor in biology in Knox College, Galesburg, Ill.

Dr. F. B. Peck has been made associate professor of geology and paleontology at Lafayette College.

Dr. G. A. Tawney, assistant in Princeton University, has been appointed to the chair of philosophy in Beloit College, vacant by the death of Prof. Blaisdell.

At Cornell University an Oliver Graduate Scholarship in Mathematics, of the annual value of $300, has been founded in memory of James Edward Oliver.

The number of students registered in the College of Physicians and Surgeons, Columbia University, up to November 1st, were 625, of whom there are in the first

year 279, in the second year 158 and in the third year 147. There will be no regular class graduated this year, it being the first in which the four years course has taken effect. The temporary decrease due to the lengthening of the course has this year been made up, and next year with the four classes the attendence will be very large.

THE Cornell University Register for 1896–7 has already been issued; it shows a registration of 1763 compared with 1684 at the same time last year, this being the largest registration hitherto recorded. The faculty also shows an increase, the total number of instructors now being 175. The Library records a gain of 12,890 books and 1200 pamphlets since last year.

AT Cambridge University Dr. L. E. Shore, of St John's College, has been appointed a university lecturer, and Mr. Eichholz, of Emmanuel College, an additional demonstrator in physiology.

MISS KNIGHT, M. B. Lond., has been appointed professor of anatomy and pathology to the Lhudiana Medical School, North West Provinces, India.

THE eighth University Extension Summer Meeting will be held at Oxford, July 31–August 25, 1897.

DISCUSSION AND CORRESPONDENCE.

THE JURA IN THE UNITED STATES.

'THE Jurassic formation on the Atlantic Coast' (SCIENCE, Dec. 1, pp. 805–816) is the most important paper on practical geology and classification published yet by Prof. O. C. Marsh. The conclusions arrived at are excellent, and the proofs given, although necessarily summary, are sufficient to warrant the exactness of the classification of the Potomac formation as belonging to the Upper Jura.

A few remarks on the history as well as on the geologic chronology may be acceptable, for, without detracting anything from the merit and great value of the memoir of Prof. Marsh, some points can be rendered more clear and easily understood, at the same time more exact.

We read: "Until a comparatively modern date, this supposed absence of Jurassic deposits was thought to be true, also, for the rest of this country. I well remember the parting advice given me by an eminent professor of geology, with whom I studied in Germany (Ferdinand Romer), 'The first thing you should do on your return to America is: look for the Jurassic formation. I am sure it is there; full of fossils.'" (SCIENCE, p. 805.) The choice of Ferdinand Romer as an adviser on the Jurassic formation in America is unfortunate, for Prof. F. Romer, during his stay in Texas, remained several months at Fredericburg, which lay on the Jurassic formation; besides he explored, in some detail, the valley of the Trinity River, where the Jura exists also, and not only did he not recognize the Jurassic formation in Texas, but by a wrong determination of a *Gryphoa*, which he identified with the *Gryphea Pitcheri*, he helped greatly the confusion created a few years later by a paleontologist who denied the existence of the Jurassic deposits of New Mexico, near the Texas line, made in 1853, by the geologist of the Pacific Railroad exploration by the thirty-fifth parallel of latitude, commanded by Lieutenant A. W. Whipple. As Prof. Marsh says, "Ferdinand Romer added much to our knowledge of the geology and paleontology of this country," for he published the first essay of a geological map of Texas in 1849, and three volumes of paleontology on Texas and Tennessee in 1852, 1860 and 1889; but at the same time it is important to notice that he did not recognize in Texas the Permian, the Trias nor the Jura; and as to the Cretaceous he failed to recognize the Lower Cretaceous, or Neocomian, going so far in his erroneous determination of age of strata as to place the Lower Cretaceous above the Upper Cretaceous, or Chalk. It is impossible to say that Romer was a good practical geologist when in the field in an unexplored country; but as a paleontologist he was more successful, although he made conspicuous errors, and displayed a want of knowledge in ignoring the Primordial fauna of Texas, which he referred to the second fauna.

The figure 1—'Geological Horizons of Vertebrate Fossils' (SCIENCE, p. 806), is rather incomplete in some important points; for instance, the Cretaceous beginning with the 'Dakota group,' which truly is only the lower division of the Upper Cretaceous, or true Chalk,

and the Lower Cretaceous, or Neocomian, so well developed in Texas (Comet Creek, Fort Washita, Comanche, etc.), is completely ignored. By *contra*, Prof. Marsh places the Laramie series in the Cretaceous. As he says, "that vertebrates afford the most reliable evidence of climate and other geological changes," it is somewhat surprising to see him put aside the beautiful discovery of an important and rather rich vertebrate fauna near Reims, in France, by M. le Docteur V. Lemoine, at Cernay and Aï, or Ay, in Champagne, absolutely identical as regards the forms and genera with what Prof. Marsh has imprudently called 'a Cretaceous Mammalian fauna' in the Laramie formation, showing 'how difficult it is to lay aside preconceived opinions,' according to his own phraseology. The Cernayrian fauna, as it is called by Dr. Lemoine and Prof. Gaudry, is Tertiary * and not Cretaceous.

The stratigraphic position of the first mammal *Dromatherium* in the Trias, according to Fig. 1 of Prof. Marsh's paper, is contrary to the opinion of the discoverer, Dr. E. Emmons, who has always referred it to the Permian, for he finds it far below the true Trias of North Carolina and Virginia.

Prof. Marsh insists on the variety of colors in the plastic clays of the Jura at Gay Head, in the Maryland, Wyoming and Colorado, saying: "Brilliant red, green and yellow tints are especially prominent, yet the white and black shades are equally noticeable" (SCIENCE, p. 812). This is very true and I saw the same striking colors in New Mexico, calling attention, as far back as 1853, to the colors of the sandstone with a remarkable yellow-citron tint and the brilliant white of other beds of sandstone at Tucumcari, Cañon Blanco and Laguna Colorado, and the blue of the *Gryphea Tucumcarii* marls at Pyramid Mount.

* SCIENCE, p. 835, in 'Scientific Notes and News,' we read that Dr. Lemoine has exhibited photographs obtained by Röntgen's rays, of fossils embedded in the *chalk* strata of Reims. The error of calling the strata near Reims, at Cernay and Aï in which Dr. Lemoine has collected fossil bones of mammals, birds and reptiles is difficult to understand, for he called them, not *chalk*, but *Tertiary* or *Lower Eocene* (*Bull. Soc. Gèol. France*, 1 Nov., 1896, pp. cxciii–cxcv).

In regard to early investigations, Prof. Marsh has the kindness to recall my contribution of 1853 in the Rocky Mountain region, when I found the Jura at the Tucumcari Mounts, Cañon Blanco, Laguna Colorado, and in the vicinity of Zuni (New Mexico and Arizona), in 1853, the Jurassic formation had not been truly recognized yet in North America, for the only indication of Prof. W. B. Rogers of the Oolitic age for the coal of the vicinity of Richmond, Virginia, was proved as early as 1849, as belonging truly to the Trias and not to the Jura.

Prof. Phillip T. Tyson, of Baltimore, after referring the red plastic clay of Maryland first to the Cretaceous in 1860, changed his view in finding specimens of *Cycadea*, and in 1862 called it Jurassic. In 1863 I saw the same formation in the vicinity of Washington and did not hesitate to call it Jurassic; but I published nothing about it, until 1888, in my paper 'American classification and nomenclature,' pp. 36–37, Cambridge, saying: "During the Civil War (November, 1863), when visiting some friends in camp around Washington, I was shown a fossil 'pineapple' found on the farm of Dr. Jenkins, one mile south of the Baltimore and Washington railroad, sixteen miles from Washington, Prince George County, Maryland. I recognized at once a well preserved Purbeck's *Cycadea* and referred the red and gray mark, in which it was found in company with pieces of petrified wood and broken pieces of indeterminable bones, to the Purbeck formation of England. The little of what I saw there reminds me of the Purbeck group, as I saw it at Portland Island and Durlstone Bay, near Weymouth, England, where so many specimens of mammalia (marsupial), reptiles, birds, turtles, fishes and *Cycadea* have been found in its celebrated 'dirt bed.'

"Lately the United States Geological Survey have called those white, red and bluish gray clays and sands *Potomac formation*. It is a fresh water deposit contemporaneous with the Purbeck strata of Swanage and vicinity, Dorsetshire, England, which represent in North America that most important upper part of the Jurassic system called now on the continent of Europe the *Purbeckian*." So the Potomac for-

mation as defined by the United States Geological Survey was referred as far back as 1888, as Jurassic formation.

JULES MARCOU.

CAMBRIDGE, MASS., December, 1896.

SOME NEURAL AND DESCRIPTIVE TERMS.

TO THE EDITOR OF SCENCE: In a recent circular asking the opinions of experts as to the prevailing and preferred usage of anatomic and neurologic terms in behalf of the projected Dictionary of Philosophy and Psychology, Dr. C. L. Herrick mentions certain terms and principles which have been either proposed or adopted by me.

But for the request to 'respond as early as possible,' I should suggest that replies be either delayed or regarded as provisional until after the appearance of my paper, 'Neural Terms, International and National,' *Journal of Comparative Neurology*, VI., pp. 216–340, December, 1896), wherein the general subject is discussed at length, and in parallel columns are given the neuronyms adopted by the Anatomische Gesellschaft in 1895 and those now preferred by me. But for the remoteness of Dr. Herrick's present address the following comments would be submitted to him first.

3 (b). For the part now called by the Gesellschaft 'Subtantia perforata lateralis' I formerly proposed *præperforata*, but since 1889 have employed *præcribrum*.

4 (e). *Metencephalon*, as employed in the last three editions of 'Quain' and adopted by me in 1881, designates the last definitive encephalic segment, *i. e.*, between the cerebellar segment (our epencephalon) and the myelon or spinal cord. As given in the circular it has two other usages, viz., either for the cerebellar segment alone (His) or for both regions (some authors). The encephalic segments will form the subject of a paper at the coming meeting of the Association of American Anatomists.

(g). *Metencoele* is doubtless a misprint for *metacoele*. The Latin (international) forms are *metacoelia* and *mesocoelia*; the national English forms *metacele* and *mesocele*.

(j). As to *Neuron* (proposed by me in 1884 as a mononym for *axis cerebro-spinalis*) see 'Reference Handbook,' IX., 100, and *Proceedings Assoc. Amer. Anat.*, 1895, 44–45. Indirect endorsement of it is contained in such compounds as *neuromere*, *neurenteric*, etc. It like manner *myelencephalon* (for either the entire cerebrospinal axis or for the last encephalic segment) embodies indirect endorsement of *myelon* for *medulla spinalis*.

As to *cephalic* and *caudal*, *cephalad* and *caudad*, during an experience of sixteen years no actual instance of misapprehension has been observed. But since they evidently are not acceptable to some, might not the increasing employment of *præ* and *post* in composition with the force of adjectives, justify taking these prepositions as the bases of adjectives, viz. *prælis*, *postalis*, England, *præal* and *postal*; adverbs, *præad* and *postad*. As mere vocables the last two are no more objectionable than *quoad*. Classic precedents for the derivation of adjectives from prepositions or adverbs are *contrarius*, *extraneus*, *proprius*, *crastinus*, *pristinus*, *interior*, *supernus*, and ἀηώτερος. BURT G. WILDER.

ITHACA, N. Y., December 19, 1896.

SCIENTIFIC LITERATURE.

CARL VOGT.

La Vie d'un Homme, Carl Vogt. Par William Vogt. Avec deux portraits par Otto Vautier. Paris, Libraire C. Reinwald; Stuttgart, E. Nägele. 1896. 4°. Pp. 265.

The life of this well-known naturalist was stormy and eventful, in a degree momentous to science, and also to the political and philosophical history of his time. His son has given us a vivid portrait of an interesting character—a very positive one—who, besides leaving his imprint on the science of his day, was in some respects a many-sided man, not only being an eminent investigator, a teacher, a founder of scientific societies, a popular lecturer, a brilliant caustic writer and controversialist, but also a man of great public spirit, an active republican, almost a revolutionist, protesting and fighting during the middle of this century for right and justice against the ultra-conservative, reactionary forces in State and Church.

Carl Vogt was born in 1817 at Giessen. He was by extraction a Celt, rather than a German, and this may account for his turbulent, combative, revolutionary nature, while his pro-

testing spirit and rebellion against the theological trammels of his time betray an infusion of German blood. His materialism he inherited from his father, and the son never deviated from the anti-theological training received under the paternal roof. His biographer writes from the same ultra-materialistic point of view, one scarcely justified in these days of broader and more liberal thought.

Vogt entered the laboratory of Liebig at Giessen, in what year his biographer does not state. Here he began his life-long friendships with Woehler, Bunsen, Hofmann, Kopp, Keculé and other chemists. His first scientific paper (1837) gave the results of a comparative analysis of the water of the amnion at different periods of fœtal life. His father, disgusted with the narrow governmental restrictions of the Grand Duke of Hesse, moved to Berne. Meanwhile at Geissen Vogt had concealed an insurgent in his room, thus risking the penalty of five years' imprisonment in a fortress. The young medical candidate escaped to Strasburg, where he soon neglected medicine and politics, devoting himself to zoology and paleontology. He then studied physiology with Valentin, and thus took his doctor's degree at the age of 21. In this year (1839) his first zoological paper, on the nervous system of Python, appeared.

Meanwhile Agassiz, already distinguished, went in June, 1838, from Neuchâtel to Berne to confer with Prof. William Vogt, the uncle of Carl, who recommended as his assistants Desor and Vogt. The former was at once invited to Neuchâtel, his comrade Vogt joining him a few months after. At this time, as is well known, Vogt wrote the 'Embryogenie et Anatomie des Salmones,' a masterly work. Here Agassiz, '*le chef inconteste*,' worked, housing, clothing and feeding his suite of proletariat collaborators, in the fashion so well known to all the world.

During this life of plain living and high thinking at Neuchâtel, from 1839 to 1844, Vogt published numerous memoirs. He also formed one of the rare spirits who tabernacled for the four summers of 1839 to 1843 on the glacier of the Aar, in the famous *Hôtel des Neuchâtelois*, 8,000 feet above the level of the sea. Here, as Blanchard wrote:

"*Agassiz ne perd jamais sa bonne humeur. Desor s'abandonne volontiers à la plaisanterie, Carl Vogt, toujours petillant d'esprit et capable de mettre en gaieté une assemblée de Trappistes, ne laisse à personne le droit de s'ennuyer.*"

For his gruff but hearty manner, Vogt received the nickname of 'Mutz,' or the bear of Berne.

In 1841, at the meeting of the German naturalists, Vogt supported, against Van Buch, the new theory of Venetz, Charpentier and Agassiz on the former extension of glaciers, and the next year appeared his *Im Gebirg und auf den Gletschern*.

In 1844 we see Vogt at Paris living in the room on the fourth story once occupied by Von Baer, his fellow lodger being Quetelet. They attended the lectures of Arago, Milne-Edwards, Brongniart and Leverrier, his evenings being passed with his fellow students Doyère, Quatrefages, Charles Martins, Bertrand, Sainte-Claire Deville, Würtz, Dumas, Vulpian, Broca and others destined to become distinguished in science and literature.

The three years spent in Paris were busy, prolific, fecund. His vacations were spent partly at St. Malo, where he worked on the embryology of gastropods; other summers were spent in Brittany, in the Black Forest and in the Vosges, and a winter in Italy; afterwards he worked at Nice, and finally at Villefranche. In 1846 appeared his Lehrbuch der Geologie und Petrefactenkunde, which went through five editions; discarding the theory universally held as to the molten interior of the earth, Vogt boldly claimed that the heat was due to metamorphism.

The Physiologische Briefe (1847), in two volumes, with its audacious views and uncompromising materialism, its caustic irony and thrusts at everything venerated by the clerical circles, made a great stir. It was widely read in the German universities and translated into various languages. It treated, for the first time, of the embryonic development of the human body, showing to the laity that man's development is like that of the brutes. Vogt's famous definition of thought has scarcely yet ceased to be criticised and execrated in some quarters. He wrote: "*Toutes les proprietés que nous desig-*

*nons sous le nom d'activité de l' âme, ne sont que les fonctions de la substance cérébrale, et pour nous exprimer d' une façon plus grossière, la pensée est à peu pres au cerveau ce que la bile est au foie et l' urine au rein. Il est absurde d' admettre une âme indépendante qui se serve du cervelet comme d'un instrument avec lequelle travaillerait comme il lui plait.''** But, through Du Bois-Reymond, many have been led to believe that it has a basis of truth, and now nobody is shocked, it may serve as a working hypothesis for the psychologist. Its lack of reserve on philosophical and theological points, its outspoken denial of the immortality of the soul, and other rude and unnecessary thrusts at what was and is held dear by all Christendom, led to the general condemnation of the book.

As late as 1875 the Bishop of Orleans, criticising the review of the French translation of this book, claimed that the 'honteuses et funestes doctrines' expressed in it afforded a basis for the revival of communism in Paris. Even on May 8, 1895, a French Catholic writer ranked Vogt as a moral monster, even claiming that he was as bad as some of the noted murderers of the age.

He also horrified all Europe in another way. Up to 1848 custom demanded the use of the razor. Vogt was the first man in Germany to wear a beard.

He applied for the professorship of zoology at Giessen, the place of his birth, for which he was warmly recommended by Arago, Agassiz, Liebig and others, and despite the detraction and gossip of his opponents he was elected. He arrived at Giessen in April, 1847. The opening address of the new professor electrified the students, who were struck, as his biographer says, by the elevation of his instruction, the ascendency of his amiable spirit and his simple unpretending manner. He had added the last details to the construction of a laboratory of zoology when rumors of the revolutionary movements of 1848, which shook the continent to its foundations, spread through the country and entered the university town of Giessen. Vogt was a republican, but not of the red shade of the French school. He detested Robespierre and his allies. In later times he showed no sympathy with socialists or anarchists. He simply strove for freedom of thought and for justice to the middle classes, such as is now enjoyed, and opposed the reactionary spirit of the wealthy aristocratic and ultra-clerical circles. He was sent to the Parliament and directed the radical left. His polemical spirit, his incisive, caustic raillery, with his persuasive eloquence, his sincerity of conviction and his civic courage, coupled with his lack of pessimistic spirit, made him conspicuous and obnoxious. He was, in consequence of the rising of the republican element, of which he was a natural leader, unseated from his chair at Giessen, in which he was succeeded by R. Leuckart, the 'Nestor of German zoology,' now the distinguished teacher of so many distinguished zoologists at Leipzig. He fled with other refugees to Switzerland, settling down at Berne, but soon went thence to Nice and resumed his former quiet life as an investigator and writer. In 1851 he translated the 'Vestiges of Creation.' The '*Recherches sur les Siphonophores de la mer de Nice*' appeared in 1852.

This volume with his embryology of the salmon, placed him in the first rank of gifted investigators, such as Huxley, Kölliker, Leuckart, Gegenbaur and Milne-Edwards. His sketches were beautifully drawn, his talent for observation had now greatly developed and matured, and his views were original. Meanwhile, he put out a popular work, characterized as before by a trenchant, iconoclastic, uncompromising hostility to the prevailing philosophy and theology. His *Recherches sur les Colonies Animales*, a philippic bristling with political illusions, was placed on the index by the Prussian government, and a writer of the day, on account of the 'heresies and blasphemies of this frivolous and trivial book,' stigmatised it as 'an eternal stain on the zoological literature of Germany.' One of his most successful and widely read books was his '*Zoologischer Briefe*,' sent to the printer in 1851.

* This expression is substantially in Cabanis, who says: The brain produces 'la sécrétion de la penseé (Rapports du Physique et du Moral de l' Homme, Paris, 1844, p. 138). See Lange, ii., p. 312, foot-note, who adds, the editor, L. Peisse, remarks on it: 'Cette phase est restée célèbre.'

Like his other books the style is clear, forcible, piquant, sometimes highly colored, but solid in its facts.

After his acceptance of the chair of geology and zoology at Geneva, which he was at first unwilling to take, Vogt rendered, besides his academic work, public services to his adopted country, aiding with his geological knowledge in the building of railroads, reporting on the geology of the Credo tunnel. He was a member of the Grand Council of the Canton of Geneva from 1856 to 1862, and at other periods until 1880, and of the National Council from 1878 to 1881, and showed his public spirit in other ways, at times when the calm of public life was not always serene and perfect.

His ability and foresight as a man of affairs of the liberal or even radical school, is shown in his open letter in 1859, when he demanded the freedom of Italy and of Hungary, and the unity of Germany. Again, after the Franco-German War of 1870, he suggested that as a means of lasting peace Alsace be given up to the French, truly a statesman-like proposition.

With Sars, Agassiz and Quatrefages, Vogt was one of the first to study living animals at the seashore in an improvised laboratory; but while at Villefranche, in 1850, working on the Siphonophores, he insisted on the importance of laboratories of marine zoology, and the part they should take in the progress of this science, and brought all the influence he could to bear on the Minister of Public Instruction of Austria, to establish a zoological station on the Adriatic sea, at Misamar. Three years later he labored with the Minister of Public Instruction of France to establish such a station at Nice, and recommended as professors, MM. Lacaze-Duthiers and Blanchard. He exerted all possible pressure, says his biographer, on his influential friends in France, Spain, Austria, Germany and Italy to bring about this end, and, we are told by his biographer, it was at his instance and at his instigation that Dr. Anton Dohrn, then (in 1868) at the Congress of Naturalists at Innsbruck, decided to found, at his own expense, the zoological station of Naples, now so successful and magnificent in all its arrangements. He also rendered disinterested services to Lacaze-Duthiers in establishing the admirable station at Roscoff, where he spent several summers, working up there his *Recherches cotières*, and seconded, according to his means and influence, the station of Marion at Marseilles, of Giard at Wimereux, and of Sabatier at Cette. Of late years and up to the year of his death, Vogt worked with his students at the Russian station at Villefranche.

We now have to consider Vogt as an evolutionist. His antipathy to metaphysics and to the philosophy taught when he was young was pronounced. But from the first he sympathized with evolutionary philosophy, and before the time of Haeckel was the leading propagandist of the theory of descent in Germany, and for his active warfare in this direction has been called the Huxley of Germany and Switzerland. He translated the 'Vestiges of Creation' soon after it appeared. With Claparède and DeCandolle, the Gevenese zoologist at once accepted the principles set forth in Darwin's Origin of Species. Even to Vogt it was a revelation.

As early as 1843, in his Embryologie des Salmones, Vogt wrote: "*Le developpement d'une classe dans l'histoire de la terre offre, à divers égards, la plus grande analogie avec le dévelopment d'un individu aux differentes époques de sa vie. La démonstration de cette vérité est un des plus beaux résultat de la paléontologie moderne.*"

In 1851 in his *Zoologische Briefe* he thus expressed himself: "The species is the reunion of all the individuals which derive their origin from the same parents and which become again by themselves or by their descendants like their first ancestors." In his lectures on man, delivered in 1862, he defined a species as a compound of individuals whose characters show that they are the genuine or possible descendants from a common source. In this work he insisted that man had descended from the apes, though he wrongly maintained that the few cases of microcephalous monsters known are cases of reversion to the ape condition. He now actively spread evolutionary views, and in a letter to Huxley, dated March, 1863, he wrote that the doctrine was making "de grand progrès en Allemagne. Une foule de jeunes savants se présentent," that Virchow (now regarded as

very conservative in his views) added fuel to the flames in an article on heredity 'which is very explicit in this sense.' At the same time the radical uncompromising Vogt, when confronted with what was called Haeckelism, for once, and we believe only once, in his life took a conservative stand. The advanced views of Haeckel, then the 'enfant terrible' of Darwinism, with his genealogic tree of the whole animal kingdom, where the vague hypotheses and assertions of the Schöpfunggeschichte and Anthropogenie were treated as if generally received truths, were too much even for Vogt. His mind, so well trained in ascertaining and observing facts and in drawing safe deductions, though accustomed to give hypotheses due regard, led him to believe also that the building of genealogical trees was too premature in the biological science of that date. Vogt rebelled, and for a while a coolness sprang up between the *demi-dieu d'Jena* and himself. Vogt also apparently for the first time felt the influence of the university spirit, and, unconsciously as regards extreme evolutional views, the hair of this republican and ultra radical in religion actually stood on end, and his bold aggressive spirit became reactionary and cautious. Vogt wrote in 1877, under the title 'Apostel-, Propheten- und Orakelthum in der Wissenschaft,' a sharp criticism of Häckelismus; in a moment of genuine indignation, though with its comical side, pronouncing the views of the Jena professor as *haarstraubend*. The daring opinions of Haeckel at that time not only excited the derision of laymen, but biologists of equal rank with Vogt, among them Semper, were astonished at the lengths to which Haeckel allowed his vivid imagination to carry him, and yet at the present day Haeckel's views are moderate compared with those of some biologists. In fact, biology has shifted its methods, and a shoal of hypotheses, some probable and others incapable of proof, now occupy the field.

It was the extreme views of Haeckel against which Agassiz in the United States fought, and though he was the leader of the anti-evolution forces, he and Vogt stood on common ground, *i. e.*, of well ascertained facts, in opposing what they believed to be unsound scientific methods.

Vogt did not, however, like Fritz Müller, whose 'Für Darwin' is a classical work, make any notable contribution to the evolution theory, though upholding the doctrine of descent in its widest acceptation. He, however, did little to broaden it, nor did he, so far as we know, take up the questions now dividing evolutionists into neo-Lamarckians and neo-Darwinians. The scientific criticism of natural selection, the revival and rehabilitation of Lamarckian views, the rise of Weismannism and the search for the physical base of heredity, are the products of a later generation than that of Vogt.

In the summer of 1861 Vogt went as one of the guests of Dr. Berna to the North Cape and Jan Mayen, visiting on the way the eminent naturalist, Sars, and at Bergen Danielssen and Koren, and by the succeeding year (1862) the facile pen of Vogt had thrown off his *Nord-Fahrt entlang der Norwegischen Küste nach dem Nordkap, den Inseln Jan Mayen und Island.*

In the rise of the young science of anthropology, early in the sixties, due to the discoveries of Schmerling, of Boucher de Perthes, of Christy and Lartet, in France; of Thomsen, Nilsson, Steenstrup, Foschhammer, Gabriel de Mortillet, Capellini and others, with the works of Huxley, of Lyell and Lubbock, and the papers of Ecker, Vogt actively participated, and his lectures on man, which appeared in 1863, was a notable work. Aggressive, polemic, unlike the English and others, instead of confining himself to the subject in hand, going out of his way to attack those who differed from him on theological and philosophic subjects, the work made a great stir, perhaps more than its merits really deserved.

Vogt's opinion that microcephalous idiots are cases of reversion to their ape ancestors fell flat on the scientific ear, and indeed the fact was that Vogt himself never saw more than three perfect examples of undeniable microcephals. But the German public was profoundly moved by the popular lectures which the author of *Microcéphales ou Hommes-singes* delivered from 1867 to 1869, in the larger cities of the German Confederation, in Hamburg, Brussels, Antwerp, as well as Vienna and Buda-Pesth. In the Catholic cities he was almost mobbed; the children in the streets would

run after him crying '*Assen Vogt! Assen Vogt!*' On one occasion, while lecturing in a German city, the fanaticism of the lower classes rose to such a pitch that the windows were smashed in by a volley of stones. Vogt, without losing his presence of mind, went on to show his audience the means taken to close the road to the young science already difficult to tread, when a large pebble fell on his desk; he took it and held it up before the assembly and exclaimed: "*Je vous parlais hier des sauvages ancêtres de l'âge de la pierre; vous vous rendrez facilement compte, en ce moment, que cet âge lâ n'est par encore tout à fait terminé.*" It is said that Broca labored in vain to persuade him to respect the feelings of the lower orders.

Vogt was prominent in founding the Prehistoric Congress of Anthropology initiated by de Mortillet; read a number of papers before it, presenting at the Bologna meeting his paper, *Anthropophagie et les Sacrifices humains*, which contained some extreme conclusions as to the universality of this custom.

In 1870, during the Franco-Prussian War appeared his '*Lettres politiques*,' claimed by his biographer to be 'a fiery and eloquent protest in the name of right, justice and liberty against brutal conquest and unrighteous war,' which were widely read. He warned the French not to underrate the strength of their enemy, and *apropos* of the seizure, by Germany, of Alsace and Lorraine explained what the result has well shown, that this conquest would for a long time prevent any possible reconciliation between the two nations. He deplored the spirit of militarism, which he believed to be the cause of all the evils afflicting Europe, and longed for the suppression of great standing armies.

After this the busy student returned once more to zoology. He translated Gegenbaur's Anatomy, some of Darwin's works, and in 1875 published an *Atlas der Zoologie*. He even printed a study entitled *Structure microscopique des roches volcaniques*, and on volcanoes, and communicated these and other papers to the first meeting of the French Association for the Advancement of Science, which he was specially invited to attend. In his study of the Berlin Archæopteryx (1879), which he vainly tried to obtain for the Geneva museum, he maintained that it was neither a bird or reptile, but formed 'une type intermediaire des plus caractérisés et confirmes, d'une manière éclatante, les vues de M. Huxley.'

In 1879, when the anti-Semitic persecutions arose in Germany, he was among the first to defend the oppressed and plead for just and fair treatment of the Jews, and in 1893, when the anti-Semitic views penetrated into Switzerland, the last public address of the Geneva professor was read by a Federal Councillor before the National Council at Berne.

A characteristic of Vogt, showing his freedom from petty vanity, was his declination of Austrian, Spanish, Danish or Italian decorations, but he gladly accepted the cross of the Chevalier de la Légion d'honneur, given him by Gambetta, his friend and admirer.

His last work, *Traite d'anatomie comparée pratique*, written with the cooperation of Emile Yung, begun in 1888, was completed but a year (1894) before his death. He seems to have left unfinished an autobiography begun in June, 1894. Vogt died, his intellect unclouded to the last, in his eightieth year, March 5, 1895, after an illness of a few weeks.

Such is the life of this man. A busy and, for a naturalist and student, an eventful one. He was remarkably many-sided in his interests, and ever ready to drop his scalpel and pencil to take his share in public affairs.

It has been said that had Vogt not spread over so much ground and had confined himself to zoology, and to a single phase of that many-sided science, he would have taken a higher rank as a man of science. It may be said that he belonged to a school now passing away. He was the product of a transition period in the history of biology. Certainly he may be ranked as an embryologist and general zoologist or morphologist next to the best, and he was only inferior to such men as Müller, Owen, Huxley, Agassiz, Milne-Edwards. His best works in zoology were those on the embryology of the Salmonidæ and of the Gastropods, and the morphology of the Siphonophores. His attempts at classification were, however, not always successful, as seen in his separation of the Cephalopods as an independent type from the other molluscs.

He was a leader in founding the science of anthropology, but his *tour de force*, or microcephaly, was generally felt to be a mistake. As a promoter of marine zoological stations he was most useful, and he was no closet and museum naturalist, but was among the first to work by the seaside on living animals. He will be remembered as a leader in establishing the doctrine of evolution, though in advocating it he did not show the reserve as regards the supposed theological and philosophical bearings, nor cultivate the broad statesmanlike methods of Darwin, Lyell and others. As a controversialist his blows were less weighty and telling than those of Huxley, with less of his refinement, clearness and elegance of style, and knowledge and wide reading in philosophical literature. His life, however, was devoted to the good of his race. Though his religious nature was never cultivated, his moral nature was without a stain. His turbulent Celtic blood asserted itself at times, and his large patriotic heart led him to sympathize with the down-trodden and oppressed, and unlike most students he could doff his gown and rush into political struggles and wage effective warfare with voice and pen. Vogt's materialism, as well as Spencer's agnosticism, may answer a temporary purpose for the scientist as such, but not for the philosopher. We have to go outside the material and phenomenal world for an explanation of the universe. Vogt's position as a philosopher of the materialistic school is amply discussed by Lange in his History of Materialism, where he compares him with Moleschott. "Both men," he says, "though not without the stimulus of original research, shine chiefly in their talent for exposition. If Vogt is clearer and sharper in detail, yet Moleschott had given more thought to the rounding of the whole. Vogt more frequently contradicts himself; Moleschott is richer in propositions to which it is impossible to attach any definite meaning" (11, p. 264). But, as Lange well remarks in another place, "the whole cause of materialism is forever lost by the admission of the inexplicableness of all natural occurrences." Vogt's philosophical narrowness and opinionativeness is shown in his never changing his views in the later years of his life, when the occasion, if it ever occurred, for ultra materialistic views had passed away, to be replaced by agnosticism and by the monistic philosophy of Haeckel and others. It is sufficiently obvious that Vogt was unideal and unspiritual, practical and matter of fact, and quite unsuspicious of his own lack of breadth and grasp. His own studies must have constantly led him into the region of insoluble problems, but his modesty and humility was not of the order of Newton's, and he seemed utterly unconscious that he could not with a few words or strokes of the pen settle questions which have, and perhaps always will, baffle the keenest intellects and the most thoughtful minds.

Vogt, with whatever limitations he had, was a genuine man and true to his friends, with no personal enemies. The two portraits well delineate the man; not particularly winning or refined in features, but strong and true, reliable and earnest. The full-length portrait admirably depicts the man as we saw him one Sunday afternoon in 1889 in his laboratory at Villefranche. His students were out for a holiday and the old man was at work alone making a sketch of a jelly fish or some such creature, to be reproduced in his Traité d'anatomie comparée, on which he was then busily engaged. Affable and courteous, he took pleasure in showing us the simple apartments of the station, then under the direction of Prof. Korotneff.

The book is certainly not dull reading; it is enlivened by many characteristic anecdotes; at times it is a grain too eulogistic and uncritical, and the author's extreme radical and materialistic and anti-religious views in a degree warp his judgment and affect the saneness of some of his reflections. It would have been well if the book could have been revised by some scientific friend of the deceased.

We would have liked to see more of Vogt's own letters; remarkably few are given, nor are the summaries of his chief works sufficiently full and complete, or the dates always given, or the quotations accompanied by references to the title and page.

Had the book been written by an American, it is safe to say in these days of bibliographies, that a suitable one would have been added to this life, since Vogt lived in a transition period,

his earlier papers being included neither in Agassiz and Strickland's Bibliographia zoologiæ, which ends with 1854; nor in Taschenberg's, which begins with 1861; nor in the catalogue of the Royal Society. A. S. PACKARD.

Number and its Algebra; Syllabus of Lectures on the Theory of Number and its Algebra. By ARTHUR LEFEVRE. Boston, Heath. 1896. pp. 230.

In June, 1891 was published the first piece of a treatise entitled 'Number, Discrete and Continuous,' in which were set forth some doctrines which seemed to the writer, the present reviewer, as new as they were fundamental.

It was there maintained that counting is essentially prior to measuring, but also that the primary number concept is essentially prior to counting and necessary to explain the meaning, cause and aim of counting.

It was there maintained that integral number had not a metric origin, nor was metric in its original purpose; that integral number did not involve the idea of ratio, that in fact it was enormously simpler than that very delicate concept, *ratio*.

Number is primarily a quality of an artificial individual.

The stress laid upon it, the importance attached to this quality, comes first from the advantage of being able to identify one of these artificial individuals. By artificial is meant 'of human make.'

The characteristic of these artificial individuals is that each, though made an individual, is conceived as consisting of other individuals.

This explanation was set forth again concisely in an article entitled 'The Essence of Number,' in SCIENCE, Vol. III., pp. 470, 471.

The primitive function of number is to serve the purposes of identification. But again, counting, which consists in associating with each primitive individual in an artificial individual a distinct primitive individual in a familiar artificial individual, is thus itself essentially the identification, by a one-to-one correspondence, of an unfamiliar with a familiar thing. Thus primitive counting decides which of the familiar groups of fingers is to have its numeric quality attached to the unfamiliar group counted.

This primitive use of number in defining by identification is illustrated by an ordinary pack of playing cards, where the identification of King, Queen and Knave is not more clearly qualitative and opposed to every mode of measurement than is the identification of ace, deuce and tray; and, indeed, that the King outvalues the Knave has more to do with measurement than the fact that the ace outvalues the tray.

Counting implies, first, a known series of groups, mental wholes each made up of distinct wholes; secondly, an unfamiliar mental whole; thirdly, the identification of the unfamiliar group by its one-to-one correspondence with a familiar group of the known series.

Absolutely no idea of a unit, of measurement, of amount, of value, or even of equality, is necessarily involved or, indeed, ordinarily used. One counts when one wishes to find out whether the same group of horses has been driven back at night that were taken out in the morning; where counting is a process of identification which it would seem intentionally humorous or comical to try to connect fundamentally with any idea of a unit of reference or of some *value* to be ascertained, or of the setting off of a horse as a sample unit of value and then equating the total value to the number of such units. Such an *argumentum in circulo* may perhaps be funny, but it is neither fact nor mathematics. Mathematics afterwards defines numerical equality by means of one-to-one correspondence, which is absolutely distinct and away apart from the idea of ratio. We may say with perfect certainty that there is no implicit presence of the ratio idea in primitive number.

From the contemplation of the primitive individual in relation to the artificial individual spring the related ideas 'one' and 'many.' An individual thought of in contrast to 'a many' as not-many gives the idea of 'a one.' A many composed of 'a one' and another 'one' is characterized as 'two.' A many composed of 'a one' and the special many 'a two' is characterized as 'three.'

And so on; at first absolutely without counting, in fact before the invention of that patent process of identification now called counting.

For a considerable period of its early life every child uses a number system consisting of only three terms, *one*, *two*, *many*, and no counting. As datum may be taken a psychical continuum, and distinctness may be found the outcome of a process of differentiation; but what may be spoken of as the physically originated primitive individuals, however complete in their distinctness, have no numeric suggestion or quality.

The intuitive but creative apperception and synthesis of a manifold must precede its conscious analysis, which alone gives number.

It is only to conceptual unities that the numeric quality pertains. Such conceptual unities are of human make, and in a sense are not in nature, while, on the other hand, though the world we consciously perceive is out and out a mental phenomenon, yet the primitive individuals, distinct things, while forming part of the artificial unities, exist in another way, in that they are subsisting somehow in nature as well as in conscious perception.

With the preceding hints as to the reviewer's position in reference to fundamental matters in regard to which some strange blunders have been made of late by eminent philosophers and teachers, not mathematicians, it will be easy to understand why Lefevre's 'Number and its Algebra,' seems to us of exceptional importance just now to American teachers in general and teachers of pedagogy in particular. It is exceedingly timely, philosophic, bold, yet withal sound.

That the book was written down under exceptional difficulties makes only more noteworthy its general and sustained excellence.

That American teacher who does not read it is certainly doing an injustice to himself. In genuine compliment to the book, some points may be mentioned which the reviewer would have wished otherwise.

The fundamental idea of measurement comes perilously near to being misconceived. Section 12 says: "To the man whose concept of number is only what has been defined as primary number, measurement is hardly to be distinguished from counting. For measurement of discrete magnitude is counting; and to the intelligence supposed there is no real measurement of continuous magnitude." Now, on the contrary, the number or numeric picture of a group is a selective photograph of the group, which takes or represents only one quality of the group, but takes that all at once.

This picture process only applies primarily to those particular artificial wholes which may be called discrete aggregates. But the overwhelming importance of the number-picture, primarily as a means of identification, led, after centuries of its use, to a human invention as clearly a device of man for himself as is the telephone.

This was a device for making a primitive individual thinkable as a recognizable and recoverable artificial individual of the kind having numeric quality.

This recondite device is measurement. Measurement is an artifice for making a primitive individual conceivable as an artificial individual of the group kind, and so having a number picture. The height of a horse, by use of the unit 'a hand,' is thinkable as a discrete aggregate, and so has a number-picture identifiable by comparison with the standard set of pictures, that is by counting, as say 16.

And directly contrary to the position of Prof. Lefevre, the measurement of continuous magnitude surely came at just the very stage of intelligence to which he denies it, for the fraction had this very origin; it originated from the invention, the device, measurement.

Number long preceded any measurement, but measurement long preceded any idea of number as continuous.

In fact, measurement suggested not only fractions, but later the finer, more geometric idea, ratio, as is clearly presented in §80.

In Euclid's wonderful Fifth Book a ratio is never a number.

Newton, with the purpose of taking in the so-called surds or irrationals of arithmetic and algebra, assumed a ratio to be a number. Any continuity in his number system comes then from the continuity in the magnitude whose ratio to a chosen unit for that magnitude is taken. He never gave any arithmetical or algebraic proof of the continuity of any number system.

Certain passages in Mr. Lefevre's book might easily suggest that somewhere in it, never cited, he has himself treated this basal problem of

modern mathematics, which Newton never touched, and which has only been made imperatively necessary by the discovery of non-Euclidean geometry. As one of many, take this sentence from his introduction, p. 14, "I am well aware that there are other avenues of approach to the thesis here maintained,—that 'various new mathematical conceptions have been employed by Weierstrass, G. Cantor and Dedekind in establishing three independent and equally cogent theories which should prove the continuity of number without borrowing it from space,' to say nothing of such theories (*e. g.*, Fine's *Number-System*) as are 'content to get continuity from the line.' The criticism of Fine, here quoted from Halsted's *Number, Discrete and Continuous*, was acknowledged as valid in a public meeting of the American Mathematical Society, but it applies with equal cogency to Lefevre, who here mentions it. In § 41, page 43, Fine outlines an argument for the continuity of the number system from the assumption of measurement or obtaining ratio by geometric congruence and the assumption that 'the geometric magnitudes are continnous.'

Lefevre does not devote even a single section, nor indeed even a single word, that I can find, to any attempt at proving even any piece of a number system continuous.

Neither Fine nor Lefevre give any hint that they have yet heard of the fact that the non-Euclidean geometry has made it a life-or-death matter for mathematics to have a continuous number system not based in any way upon geometric congruence, and so absolutely independent of measurement and ratio.

But this new problem the book under consideration does not pretend to have attacked. More than justified is its modest claim put forth on page 112: "It seems to me something to put neomonic numbers on the same footing as negative numbers, or even numerical fractions."

George Bruce Halsted.

Austin, Texas.

Pioneers of Science in America. With portraits. Edited and revised by William Jay Youmans, M. D. New York, D. Appleton & Co. 1896.

This octavo volume consists of fifty biographical sketches of early American scientists with descriptions of their scientific work. Originally they appeared in *Appleton's Popular Science Monthly*, but have since been revised, and additions made to them for their present form. The first of these sketches is on Benjamin Franklin, our first great American scientist, and is from the pen of Mr. W. H. Larrabee, of the *Popular Science Monthly* editorial staff. The scientific attainments of Franklin have never yet been fully appreciated and Dr. Youmans, who edited the collection, well says in his preface that the present article 'is the first systematic account of what Franklin did in science that has appeared.' The reference on page 10 to Dr. Goode's paper, read at the time of the commemoration of the centennial of Franklin's death by the American Philosophical Society, is suggestive of the fact that for many years Dr. Goode claimed that the beginnings of science in this country could invariably be traced back to Franklin.

A sketch of the two Bartrams, father and son, follow, and soon after these one of David Rittenhouse, who succeeded Franklin in the presidency of the American Philosophical Society. These, together with the sketches of Benjamin S. Barton, Gerald Troost, Robert Hare and others, make conspicuous the fact that early in the century Philadelphia 'presented more advantages in science than any other place in the country.' And so, according to the sketch of the elder Silliman, he went there for instruction in chemistry to Hare, and took lectures in botany of Barton. Silliman's able pupils, including Edward Hitchcock, Dennison Olmsted and Charles U. Shepard, find a place in the book. New York comes in for its full share with the account of Samuel Latham Mitchell, who was the Franklin of the metropolis, so universal was his knowledge. Dr. Francis said of him: "In the morning he might be found composing songs for the nursery; at noon dietetically experimenting and writing on fishes, or unfolding to admiration a new theory on terrane formations; and at evening addressing his fair readers on the healthful influence of the alkalies and the depurative virtues of whitewashing." Nor is David Hosack omitted. It was he who in 1801 founded the Elgin Botanical Garden in New York City, which property

afterwards was given to Columbia University. Torrey, who later was called to the Chair of Botany in Columbia University that had been held by Hosack, with his many and valued scientific attainments, is described at length. The early history of geology in New York State is recalled by the sketches of William W. Mather, Timothy A. Conrad, Ebenezer Emmons and Lardner Vanuxem, who with James Hall constituted the chiefs of the first geological survey of the Empire State. The pioneer in science at Harvard was John Winthrop, who was 'better entitled to the character of a universal scholar than any individual of his time in this country.' Other Harvard scientists included in the volume are William C. Bond, who founded its astronomical observatory, and Louis Agassiz, to whom we owe the Museum of Comparative Zoology in Cambridge. Two of Agassiz's associates, Guyot, the geographer, and Lesquereux, the paleobotanist, are appropriately treated. In a popular work, such as the present volume, a sketch of S. F. B. Morse may perhaps be necessary, but when we consider that "the essential features of the telegraph of to-day consist solely of the work of Joseph Henry and Alfred Vail," and to quote from the sketch of Henry (p. 358), "The principles I had developed were applied by Gale to render Morse's machine effective at a distance," it would seem that the space given to Morse could with propriety have been assigned to some other worthy. Of the Washington scientists Bache, Maury and Espy, as well as Henry, have been included. The Espy sketch is somewhat faulty, having been prepared from Mrs Morehead's reminiscences. Prof. Espy's work was chiefly done while in the service of the navy department and at the Smithsonian Institution, of which he was never a regent. The absence of sketches of J. C. Redfield, our greatest meteorologist subsequent to Franklin, and of Henry D. Rogers, the able geologist, is probably explained by the fact mentioned by Doctor Youmans in the preface namely: "Should the book be found of sufficient interest to warrant the venture, a second volume on a similar plan may follow."

Taking the book as a whole, it is almost entirely free from errors and may be regarded as the best contribution to the history of American Science that has yet appeared.

MARCUS BENJAMIN.

Auto-Cars, Cars, Tram-Cars and Small Cars. By D. FARMAN, M. E., M. I. E. E.; Translated from the French by L. SERRAILLIER. With a preface by BARON DE ZUYLEN DE NYEVELT, President of the Automobile Club of France. With 112 illustrations. London, Whittaker & Co.; N. Y., The Macmillan Co. 12mo., pp. 249. $1.50.

This little book presents an excellent discussion of a branch of engineering which has recently assumed great importance in the eye of the public and, perhaps to less extent, in the opinion of the engineering profession. The revival of the once extensively introduced and very successful automobile system of transportation on the highway which, sixty years ago and more, had come to be a well established branch of locomotion, has attracted the attention of the whole world. Steam carriages, petroleum engines, electric apparatus, are coming into view in all civilized countries, and in great number and variety. This volume gives an interesting, an accurate and a very complete account of the 'horseless vehicles' of all classes, and is brought up to date—an unusual and most satisfactory circumstance in technical bookmaking. The introduction includes a well-planned and well-made elementary study of the thermodynamics of the case, and includes the discussion of the cycles of Carnot and of the steam-engine. An historical account succeeds in which the work of the earlier engineers in this field is described; though, singularly enough, nothing is said of the wonderful work, for the time, of Goldsworthy Gurney, of Hancock, of Sir Charles Dance, and of a dozen other inventors who successfully inaugurated this system about 1830. At that time twenty or thirty steam carriages were in regular or experimental operation in and about London, and some of them traversed thousands of miles and were employed on regular routes for months at a time, carrying thousands of passengers. It was then that the laws which have since, until recently, been fatally discriminating against that class of

motors, were instituted. The theory of the various types of motor next follows and a brief study is made of the several forms of motor now coming into use, with more or less success, in the impulsion of these 'horseless vehicles.'

The body of the work is devoted to a description of the construction of the new 'automobile' carriages which have within a few years become known on the road, and this includes an account of the forms of American as well as European apparatus which have been brought into competition in long-distance trials and races. Some valuable matter is also given in the form of reports, embodying data of interest and value to the constructing engineer.

The concluding portion of the book deals with details of construction. This is a good time to bring out such a work, and the author appears to have made a success of his part. The book is the work of an expert, and no doubt reliable as to fact as well as correct in its descriptive matter. It is well worth its price.

R. H. Thurston.

Cornell University.

SCIENTIFIC JOURNALS.

AMERICAN CHEMICAL JOURNAL, DECEMBER.

Investigations on the two Isomeric Chlorides of Orthosulphobenzoic acid: By Ira Remsen, S. R. McKee, J. R. Hunter and W. J. Karslake. These articles contain the results of investigations carried on during the last two years on the preparation and behavior of the chlorides of orthosulphobenzoic acid. They have been obtained in pure condition, the high-melting one by treating the mixture with ammonia, which destroys the low-melting one, and crystallizing the product from ligroin; and the low-melting one by fractional crystallization of the mixture. When treated with water both give the same product, orthosulphobenzoic acid. Phenol and resorcinol were also found to yield the same products with the two chlorides. When treated with aniline the high-melting chloride yields only the fusible anilide, while the low-melting one yields both the fusible and and infusible anilides. When these anilides are treated with phosphorus oxychloride they both yield orthosulphobenzodianil, from which the infusible anilide can be regenerated by boiling with glacial acetic acid, and the anil of orthosulphobenzoic acid by treatment with concentrated hydrochloric acid. The evidence shows that the infusible anilide is derived from the unsymmetrical chloride by the replacement of the two chlorine atoms by the aniline residues. When the high-melting chloride is treated with ammonia the product is the ammonium salt of benzoic sulphinide, while the low-melting one forms ammonium orthocyanbenzenesulphonate. From all the data available it seems to be hardly possible to explain the formation of the latter compound, except from the unsymmetrical chloride. The first action probably leads to the formation of an imide which by an intramolecular change passes over to orthocyanbenzenesulphonic acid. The product formed by the action of benzene and aluminium chloride was the same from both chlorides.

On the Non-existence of two Orthophthalic Acids: By H. L. Wheeler. An article was published, in the May number of this Journal, by W. T. H. Howe, on the existence of two orthophthalic acids. The work has been repeated by H. L. Wheeler, who found it impossible to prepare the new acid described by Howe. He says the experimental work is absolutely incorrect, and that only the ordinary orthophthalic acid was obtained, although the experiments of Howe's were carefully repeated a number of times.

A Pure Carbide of Iron: By E. D. Campbell. The author has succeeded in obtaining a pure carbide of iron of the formula CFe_3 by carefully annealing steel bars and then suspending them in an acid solution and passing a current through the solution. The steel-gray powder formed on the surface was removed each day with an aluminium brush, and washed and analyzed. When treated with hot concentrated hydrochloric acid the substance was dissolved, forming the chloride of iron and hydrocarbons. The latter consisted both of paraffines and olefines; but their exact composition was not determined.

The Alkali Trihalides: By C. H. Herty and H. V. Black. The authors have tested the rubidium trihalides to determine whether they are isomorphous mixtures or true chemical compounds. Repeated crystallizations failed to produce any change in the composition of the

crystals, thus showing that the substance belonged to the latter class.

Action of Water of the Hubb Coal Mine upon Cast Iron: By F. W. DURKER. This mine was flooded and was filled with water for several years. When it was pumped out the iron work was found to have undergone a considerable change. The form was the same, but the substance was now porous, soft and easily cut with a knife. The changes which had taken place are explained as follows: the iron pyrites in the coal had been converted into ferrous sulphate, sulphuric acid and sulphur. The acid dissolved in the water and attacked the castings, forming the sulphates of the metals, hydrogen and hydrocarbons. The oxygen and carbon dioxide dissolved in the water formed oxides of iron, and the bars then consisted largely of silicon with oxides of iron on the outside.

The Action of Sulphuric Acid on Anisol: By W. B. SHOBER. Various results are found recorded concerning the action of sulphuric acid on anisol. The author studied the reaction under different conditions and found that anisol disulphonic acid is formed in every case in which anisol and sulphuric acid were heated to 92°; but not if they were heated above 125°. Paranisolmonosulphonic acid was always formed, while the ortho compound was formed when the substances were brought together at the ordinary temperature. This number also contains reviews of the '*Journal of Physical Chemistry;*' '*Jahrbuch der Electrochemie;*' 'Foods, their composition and analysis,' A. W. Blyth; 'The Elements of Electrochemistry,' M. Le Blanc. J. ELLIOTT GILPIN.

SOCIETIES AND ACADEMIES.

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO.
MEETING OF DECEMBER 2, 1896.

THE meeting opened with a papr by Dr. O. P. Hay, on 'The Structure and Mode of Development of the Vertebral Column,' of which the following is an abstract:

A vertebra is in most, if not all, animals a composite structure, both in the early stages of ossification and in the preceding cartilaginous stage. The notochord, around which the vertebral centrum is developed, at a very early period secretes two sheaths, an outer one, the elastica, and an inner thicker one, the proper chordal sheath. Any segmentation of the notochord or of its sheaths is due to the development of structures lying primarily outside of the sheaths and arranged metamerically. The skeletogenous cells arise from the lower half of the protovertebra, Gadow and Abbott to the contrary notwithstanding; from these cells arise the upper and lower arches and the intercalated cartilages. In the sharks, cells from the bases of the arches pierce the elastic and enter the chordal sheath, thus giving rise to the centra of these fishes. In the bony fishes, as Gegenbaur and Balfour have shown in *Lepidosteus*, Lotz in the salmon and Hay in Amia, the elements of the vertebral centra are developed wholly outside of the elastica. In the tail of Amia there are for each myomere eight cartilages resting on the elastica, the two halves of the upper arch, the two halves of the lower arch, the two upper intercalated cartilages, and the two lower intercalated cartilages. In the dorsal region these are all present except the lower intercalated cartilages, which seem to be missing.

A deposit of bone is formed in each of the eight pieces of each segment of the tail. The four bases of the upper and lower arches are thereby joined into one of the two rings found there in each segment, the so-called hypocentrum or intercentrum; similarly the four intercalated cartilages are joined to form the other ring, the so-called pleurocentrum. In the dorsal region the bases of the upper arch take no part in the formation of the centrum, being crowded upward on the top of the enlarged intercalated cartilages. Bone spreading from the latter cartilages meets bone advancing from the bases of the lower arch. Hence the vertebræ of the dorsal region are called pleuro-hypocentra.

In *Lepidosteus* the intercalated cartilages appear to be fused into a ring around the notochord and thus fused with the bases of the upper and lower arches. Later this ring of intercalated cartilages is divided, one-half going to the vertebra behind, the other half to the vertebra in front, and these, becoming ossified, form the articular ends of the adult vertebra.

In the Urodeles the two sheaths of the notochord are enveloped as in bony fishes. Hasse

and Field are in error when they affirm that the elastica is pierced by cells from the skeletogenous layer. What they claim as the elastica is not such. The intervertebral ring of cartilage seems to be formed of the fused intercalated cartilages, just as in *Lepidosteus*, and as in this fish becomes cross-segmented to form the articular ends of the adjacent vertebræ.

A paper* by Dr. H. C. Bumpus, giving results of a study on *meristic* and *homœotic* variation in the vertebral axis in Necturus, was briefly referred to by Professor Whitman.

The scope of the paper and method of dealing with the subject will be seen in the following questions raised and answered more or less fully by the author:

1. The per cent. of variation in the attachment of the pelvic arch. Is there meristic variation and is homœotic variation associated with it?

2. Is there a ratio between the absolute length of the animal and the number of vertebræ?

3. Why does the variation tend towards *forward* rather than *backward* homœosis?

4. Occurrence of oblique or unsymmetrical sacra.

5. Is the position of the pelvic arch dependent on the ordinal position of some one segment (sacrum), or is it determined by the location of some topographical point?

6. Are there variations in the position of the pectoral arch? and are these correlated with variations in the pelvic arch?

7. Are there other skeletal variations associated with pelvic variations?

8. Are variations more frequent in males than in females?

9. Are there anatomical grounds for the theory of vertebral intercalation?

These questions and many others raised in connection with them are answered by the conditions presented in one hundred specimens of Necturus.

Dr. Bumpus has used the expressions '*forward*' and '*backward homœosis*' as defined by Bateson ('Materials for the Study of Variation,' p. 111).

The pelvic arch is attached in the majority of cases to the XIX. vertebra. The variation in position in most cases consists in attachment to the XX. vertebra, and this is called *forward* homœosis. The term 'homœosis' is an old one, and Bateson employs it in its strict etymological sense. It is not the term, but the method of defining *direction*, that is open to serious objection. It is decidedly confusing and contrary to general usage to speak of the direction of variation as forward when the homœosis is exhibited in vertebræ lying *behind* the starting point. According to Bateson's definition, if the pelvic arch in Necturus were found as far back of the normal position as the last caudal vertebra it would still be a case of forward homœosis. If the homœosis appeared in successive vertebræ, coming at each step nearer the caudal end, we should still have to defy common sense and call it 'forward.' Proceeding in this wise, we should have to speak of the formation of segments in an embryo as progressing forward, notwithstanding that we know that the development advances in just the opposite direction. From this point of view, the direction of developmental differentiation in general would be forward instead of backward.

"The development of petals in the form of sepals," as Bateson himself suggests, would be "an *outward* homœosis, while the formation of sepaloid petals would thus be called an *inward* homœosis, and so forth."

Is anything gained, except confusion, by adopting such terminology?

Bateson attempts to justify his position in the following words:

"In describing cases of such transformation in the series, it is usual to speak of structures, the pelvis for example, as 'travelling forward,' or 'travelling backward.' These modes of expression are to be avoided as introducing a false and confusing metaphor into the subject, for there is of course no movement of parts in either direction, and the natural process takes place by a development of certain segments in the likeness of structures, which in the type occupy a different ordinal position in the series. In using the expression, homœosis, we may in part avoid this confusion, and we may speak of the *variation as occurring from before backward or from behind forwards, according as the segment to*

* Soon to appear in the *Journal of Morphology*.

whose form an approach is made stands in the normal series behind or in front of the segment whose variation is being considered. The formation of a cervical rib on the seventh vertebra is thus a backward homœosis, for the seventh vertebra thus makes an approach to the characters of the 8th. On the other hand, development of ribs on the 20th vertebra (1st lumbar) is a forward homæosis, for the 20th vertebra then forms itself after the pattern of the normal 19th.''

Curiously enough the main argument is, to avoid confusion. The confusion to be avoided, however, is wholly imported in the word 'travelling.' Drop the idea of movement of parts and use the terms of direction in their usual sense, and there is no confusion. The 'confusion worse confounded' comes in when a backward direction is called a forward one, and *vice versa*. When the 20th vertebra 'becomes like' the normal 19th, the locus of the variation is behind the normal, and the direction should be defined *from*, rather than *to*, the normal. The 20th vertebra 'becomes like' one in front of it, but that does not make the *direction of variation* forward.

NEW YORK ACADEMY OF SCIENCES, BIOLOGICAL SECTION, NOVEMBER 9, 1896.

MEMBERS of the Columbia University Expedition to Puget Sound made reports on the summer's work.

Mr. N. R. Harrington gave a short narrative of the expedition, including a description of the equipment of the laboratory, dredging, investigation and plankton collection. In addition he made a report on the echinoderms, crustaceans and annelids. Mention was made of the relation of the asymmetry in *Scutella excentricus* to its habit of burrowing and its vertical position in the sand. Abundant material, both larval and adult, of *Entoconcha*. This mollusc had been noted by Miller in 1852 and Baur in 1864 in *Synapta digitata* and by Semper in *Holothuria edulis*. The present material was found in an undetermined species of *Holothuria*. About forty species each of crustaceans, annelids and echinoderms have been identified.

Mr. Bradney B. Griffin presented the following report on the platodes, nemerteans and molluscs.

The Platodes and Gephyrea are relatively scarce. They are represented solely by two dendrocoels, and one phymosoma respectively. The nemertines occur very abundantly, fully fifteen different species were obtained, most of which appear to be undescribed, though some seem to approach more or less closely the European forms rather than those of the east coast of America. The Enoplan species are the more numerous. The molluscan fauna is very rich and varied, ninety-three species of sixty-nine genera were collected. These include, among others, the large *Cryptochiton stelleri*, which when alive and expanded measures over 20 cm., besides numerous smaller species of *Mopalia*, *Katherina*, *Tonicella*, etc., that occur in vast numbers on rocks and piles between tides. The nudibranchs are notable from their bright colors and large size. One species of *Dendronotus* attains a length of over 25 cm. Cases of color variation (*Cardium* and *Acmaea*) and color series (*Litorina*) were to be met with as well as color harmonization; many chitons and limpets are colored so as to more or less resemble the speckled and barnacled rocks upon which they occur. A complete series of *Pholadidea penita* (the 'boring clam') was obtained which shows the gradual atrophy of the foot and concrescence of the mantle edges as the adult condition is attained. Specimens of *Zirphæa crispata* were collected, a related form in which the foot remains functional throughout life. A series of maturation and fertilization stages of this form was obtained. *Lepton* is not uncommon, a lamellibranch that lives commensal, attached by its byssus to the abdomen of the crustacean *Gebia*, and has caused the trophy of the first pair of abdominal appendages of its host. It has developed a median furrow on each valve in adaptation to the body form of *Gebia*. An interesting case was observed in which an otherwise nearly smooth *Placuanomia* shell had assumed during its growth the concentric raised lines of a *Saxidomus* valve upon which it was attached.

The insects are not very abundant; they are represented in the collection mainly by a few wood beetles, myriopods (*Julus*, *Polydesmus*), and a species of *Termes*.

Mr. Calkins reported on the protozoa and cœlenterates of Puget Sound and of the Alaskan Bays. The protozoa and cœlenterates collected during the summer by Mr. Calkins belong chiefly to the group flagellata for the former, and to the leptomedusæ for the latter. In addition, there are two species of hydroids—a large number considering the very limited representation of this group in the western waters. Twelve or fourteen species of actinians and about the same number of sponges, and several scyphomedusæ complete the list of cœlenterates.

Dr. Bashford Dean reported on the chordates and protochordates of the collection. The ascidians are represented by about a species, fishes by upwards of forty. The most important part of his work had been the collecting of embryos and larvæ of Chimæra (*Hydrolagus colliei*) and a fairly complete series of embryos of *Bdellostoma*, including upwards of twenty stages from cleavage to hatching. Of *Chimæra* upward of eighty egg cases had been dredged in a single day; but in every case these were found to be empty. The eggs were finally obtained at Pacific Grove, California, from the gravid females and were incubated in submerged cages. It was in this locality that the eggs of *Bdellostoma* were collected.

C. L. Bristol,
Secretary.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the 53d meeting, held in Washington, D. C., December 9, 1896, Mr. Whitman Cross gave an account of some unusually large landslides observed in the Telluride region of Colorado. The slides occur on the western face of the San Juan Mountains, where the San Miguel conglomerate and a thick series of volcanic beds rest upon Cretaceous shales. Water percolating through the upper beds has softened the shales and caused the slides.

It is clear that the slides occurred long ago when the topography of the mountain front was even more rugged than at present. Masses of rock two miles in length and more than 1500 feet in vertical dimension have slipped, apparently as a unit, for several hundred feet. In such cases the bedding of the mass dips toward the mountain from which it was detached. Subsequent slides of portions of the original mass have greatly modified the relationships of the rocks.

Mr. W J McGee detailed certain observations on 'The Formation of Arkose.' The region in which the process was observed is the eastern shore of the Gulf of California or the western coast of the State of Sonora, Mexico, about latitude 29°. The region is one of broad plains, base-leveled by sheetflood erosion, these plains being relieved by notably rugged mesas and sierras. The rocks consist largely of granites and granitoid schists, evidently of considerable antiquity, together with considerable beds of igneous rocks, tuffs, etc., probably ranging from Mesozoic to middle Tertiary in age; in the mesas and sierras the rocks are practically bare, while in the flood-sweep plains they are veneered with a thin sheet of coarse alluvium, ranging from a few inches to a few yards in thickness, which becomes fine and of considerable thickness only in the axes of the greater valley plains. Between Puerto Infierno and Punta Ygnacio (mapped in National Geographic Magazine, Volume VII., 1896, plate xiv.) the gulf shore reveals a section of rocks and overlying mantle in a range of sea cliffs, averaging 30 or 40 feet in height between the lower ranges which jut into the gulf in such manner as to form prominent points; while the shore is skirted by a wave-cut bench or terrace lying slightly below extreme low tide, averaging some 100 yards in width, beyond which the gulf deepens rapidly. The prevailing rocks are slightly schistoid granites, while the alluvial veneer is composed chiefly of granitic products. The region is one of high tides and strong tidal currents, and is subject to strong winds, rising almost daily into gales, induced by general climatic and local topographic conditions; the climate is notably arid, and no fresh waters ever flow into the gulf save locally and for a few hours after the greatest storms. In the course of a visit to the coast in December, 1895, the speaker observed the rapid work of the waves in sapping the cliffs during a gale; and on one occasion, at low tide with an off-shore wind, he passed well toward the outer margin of the wave-cut terrace, examining the débris accu-

mulated in the depressions of the rugged surface; in most cases this was found to be a coarse granular sand, made up of crystals and angular fragments of quartz, felspar, mica, etc., sometimes intermixed or superficially coated with finely comminuted and lixiviated material, but more commonly clean. It was impracticable to trace the character of the detritus below the level of extreme low tide; but everything indicated that examination beneath the waters of the gulf here would reveal considerable deposits, corresponding at least to the volume of material removed in forming the sea cliffs, which would be found to consist of such material as that observed. It was noted that off the prominent granitic points (six or seven of which were studied) the granitoid sand was coarsest and cleanest, while in the reentrants it was mixed with rounded sand and contained a larger element of comminuted material. The freshly-formed granitic sand differs from ordinary arkose, such as that of the Potomac formation, only in the more complete decomposition of the felspar and other constituents in the latter. The observations are considered of value as indicating the conditions under which arkose and mixtures of arkose with ordinary sand are produced.

Mr. Waldemar Lindgren summarized the results of his recent surveys of the mining districts of Nevada City and Grass Valley, in California, discussing the history of mining operations there, the geology, the mode of origin and character of the fissure systems, the products of vein formation, etc.

These important districts are situated on the western slope of the Sierra Nevada, in Nevada county, at an elevation of 2,500 feet, and within them are a great number of important gold deposits, consisting of quartz veins and gravels. The districts have been worked continuously since 1849. At present the quartz mining industries are by far the more important. The districts are estimated to have produced a total of $113,000,000.

These districts together form the subject of a folio of the Geologic Atlas of the United States, but just issued from the press, as well as of a treatise, which will be published within a month as a part of the Seventeenth Annual Report of the Director of the United States Geological Survey.

W. F. MORSELL.

U. S. GEOLOGICAL SURVEY.

BOSTON SOCIETY OF NATURAL HISTORY.

THE first general meeting of the season was held November 4th, one hundred and seventeen persons present.

Prof. George Lincoln Goodale spoke of the reclamation of deserts. The differences between deserts were described and their various aspects noted. The end of Cape Cod was cited as an example of a desert near at hand, and the scanty vegetation of Sable Island and the difficulty of inducing plants to flourish there were mentioned. The distribution of desert plants was noted, and the effects of aridity, the changes brought about by the introduction of water, and the various kinds of water in the soil, were fully described.

Views of typical deserts in Australia, Africa, and in other parts of the world were shown, Prof. Goodale concluding with an account of the effects of irrigation and of some of the practical difficulties arising therefrom.

SAMUEL HENSHAW,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science of St. Louis on the 7th of December, 1896, Prof. H. S. Pritchett presented a paper giving the results of measures of double stars, mostly close binaries, made with the 12½-inch equatorial of the Glasgow Observatory. These observations, compared with similar ones made by him fifteen years earlier, showed some remarkable changes, particularly in the case of 70 Ophiuchi, in which the companion had described an arc of 102°. Others, as Σ 2120, showed that the motion of the companion star was independent of the brighter one. The speaker gave a general statement of the method of measuring double stars and the method of determining the apparent and true orbits.

Mr. Wm. H. Roever presented an abstract of a paper on the geometrical properties of lines of force proceeding from electrical systems, in which he showed:

(a) That the curve representing a line of force

proceeding from a system consisting of an electrified plane and an electrified line parallel to the plane, is the locus of the intersection of two straight lines having motions in a plane which is perpendicular to the electrified line; one line having a motion of uniform rotation about the electrified line as an axis, and the other a motion of uniform translation perpendicular to itself and parallel to the electrified plane.

(b) That the curve representing a line of force proceeding from a system consisting of an electrified plane and an electrified point is the locus of intersection of two straight lines having motions in a plane, which passes through the electrified point and is perpendicular to the electrified plane; one line having a motion of rotation about the electrified point and the other a motion of translation perpendicular to itself and parallel to the electrified plane. The rotation is such that the versine of the angle which the rotating line makes with $o\gamma$ (a line which passes through the electrified point and is perpendicular to the electrified plane) changes at a uniform rate, and the translation is such that if the moving line were the meridian line of a cylinder of revolution whose axis is $o\gamma$, the area of cross section of the cylinder would change at a uniform rate.

Mr. Roever also showed other properties of the above lines of force.

One active member was elected.

WILLIAM TRELEASE,
Recording Secretary.

SCIENCE CLUB AT THE UNIVERSITY OF WISCONSIN.

THE first regular meeting of the Science Club of the University of Wisconsin was held Tuesday, November 10th, the regular programme consisting of a discussion by E. A. Birge on 'The Crustacea of the Open Water of Lake Mendota,' and a paper on 'the Radiophone' by C. M. Smith. Mr. Birge, in speaking of the vertical distribution of the limnetic crustacea, enumerated the factors which effect the distribution, and illustrated the action of each factor by its effect on different species of the crustacea. Especial attention was called to the fact that in summer the crustacea do not descend below the 'Sprungschicht' of temperature, but stop abruptly at that level. This was regarded as due, not to temperature directly, but to the accumulation of decomposition products in the deeper water. Mr. Smith's paper reviewed the principal phenomena which have led to the conclusion that the production of sounds of definite pitch is a general property of all matter, whether solid, liquid or gaseous, when placed in the path of rapidly intermitted heat radiations; the pitch corresponding to the rapidity of interruptions of the rays. He further showed the application of the method to the study of emission and absorption phenomena.

WM. S. MARSHALL,
Secretary.

THE BOTANICAL SEMINAR OF THE UNIVERSITY OF NEBRASKA, DECEMBER 5, 1896.

The Polyphyletic Grouping of the Lichens, MR. CLEMENTS. *Mycological Statistics of Nebraska*, MR. POUND. *The Comparative Anatomy of the Pistil in Apocarpous Families*, MR. ERNST BESSEY. *Phytogeographical Notes from Colorado*, MR. SHEAR.

NEW BOOKS.

The Microscope and Microscopical Methods. SIMON HENRY GAGE. Ithaca, Comstock Publishing Co. 1896. Pp. xii+237. $1.50.

The Principles of Sociology. HERBERT SPENCER. New York, D. Appleton & Co. 1896. Vol. III., pp. x+645. $2.

List of the Vertebrated Animals now or lately living in the Gardens of the Zoological Society of London. London, Longmans, Green & Co. 1896. Pp. xvi+724.

Prehistoric Man and Beast. H. N. HUTCHINSON. New York, D. Appleton & Co. 1897. Pp. xxi+298. $3.

A Text-book of Special Pathological Anatomy. ERNST ZIEGLER. Translated and edited from the Eighth German Edition by DONALD MACALISTER and HENRY W. CATTELL. New York and London, The Macmillan Co. 1896. Section I.–VIII. Pp. xix+575+xxxii.

Elementary Meteorology for High Schools and Colleges. FRANK WALDO. New York, Cincinnati and Chicago, The American Book Company. 1896. Pp. 372.

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